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A Successful Attempt to Co-operate

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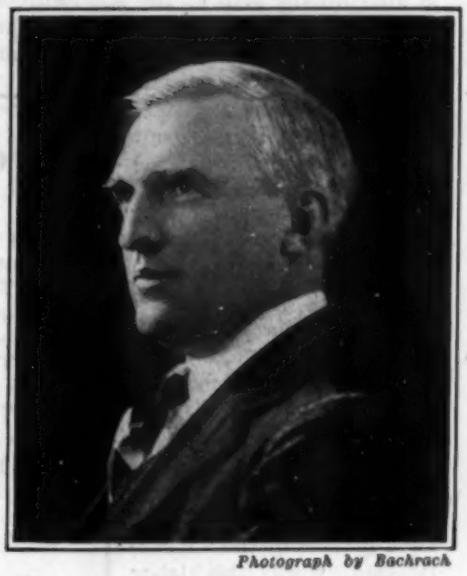

Photograph by Bachrach

How the Building Industry of New York Is Solving Its Problems

THE New York Building Congress is an organization made up of those engaged in all branches of the building industry in the metropolitan district of New York City. Its six major groups or elements comprise investment, design, management, labor, material supply and related interests, all of which are joined together in the common association with the idea of improving conditions in the building industry and its relation to the public. To this end the Congress deals essentially with the basic relationships in the industry that are of mutual interest to the industry as a whole throughout the entire community. Organized in 1921, it represents the first formal body of its kind to begin actual operation but at the same time it is a part of a more general development which has found expression in the inauguration of building congresses in other important cities in various parts of the country along similar lines.

Its great appeal is shown in the fact that from a membership of 450 during its first two years of existence it has grown to number within its membership approximately 1,500 firms and individuals in Greater New York. This growth, like the membership during the first two years, has sprung from every branch of the industry and continues at a very healthy rate.

Its appeal is even more forcefully seen in the character and scope of its activities. The first movement to be encouraged by the Congress was the establishment of an Apprenticeship Commission, which was under the leadership of Burt L. Fenner of McKim, Mead and White. This Commission has been organized and operating since August 1, 1922. It is composed of both employers and labor, as well as architects and engineers and realty, investment and other interests. The work of the Commission is both promotional and administrative in nature. Thus, it gets the Employers Association and the Labor Union in each trade first to agree upon a program for the employment, rules, regulations and education of apprentices. Then, under the general direction of the Apprenticeship Commission the work in each trade is carried on mutually in the Joint Apprenticeship Committee of the trade, made up of representatives of employers and labor. The training itself comprises instruction both on the job and in school. Through the co-operation of the New York City Board of Education the apprentices attend the evening vocational schools two nights a week for two hours a night to receive instruction in principles that

A POINT about the New York Building Congress that should be emphasized is that it is an independent local body. It represents the effort of the men engaged in the building industry of one locality to solve their own problems without calling on State or Federal organizations to carry the load.

The idea has turned out to be so practicable and successful that an account of it has been set down with the thought that it might be applicable to other trades in other communities. It should be remembered that the building industry in New York City is run, in general, on the closed shop basis. Such a situation does not always exist and therefore each community that adopts the idea must work out the details to meet its own particular conditions.

cannot be readily learned on the job. The Commission has been of great help in telling the vocational school instructors what is needed from them in the way of instruction.

Figures show that approximately 2,500 apprentices are now working in the various trades. The first trade to approve the plan of the Apprenticeship Commission was the carpentry trade, but the painters and decorators, cement masons, electricians, upholsterers, plasterers, stone masons and cabinet makers quickly followed. The most recent trade formally to adopt the program is the bricklayers who have turned over approximately 1,600 apprentices to the Commission.

The work is featured by annual exercises for apprentices, at which diplomas are awarded to boys who have satisfactorily completed their four-year period as apprentices and prizes are awarded to the best students in each class. In all phases of the apprenticeship work the labor unions have co-operated to the fullest extent.

Another problem to receive the early consideration of the Congress, through its Committee on Seasonal Employment, was that of all-year employment and particularly the promotion of winter construction. Aside from issuing a bulletin with charts showing the ups and downs in employment throughout the year, the program of the Congress includes recommendations for carrying on of major building operations and the holding over of as much repair work as possible to the fall and winter months, so as to promote continuity of employment for labor and regularity of demand for materials, with their consequent advantages to the workers and manufacturers and cheaper costs to the public. The widespread publicity given to the reports of the committee and the general luncheon meetings held on this subject last winter have done much not only to show the feasibility of winter construction, but to promote it in practice.

Recognizing the advantages in economy, efficiency and promotion of good will to be secured through the arbitration of commercial disputes, the Congress has established an Arbitration Court where any dispute or controversy which arises from time to time in the industry may be taken up. A panel of fifty competent arbitrators is at the service of disputants, and machinery to insure proper and effective handling of all cases has been in operation for some time. The satisfactory results attained from the cases already tried through this court attest to the great value of this work as a continued and permanent feature.

Through the efforts of the Standards Committee of the Congress with the co-operation and advice of the employers, manufacturers, workers and other interested groups, specifications of materials that are becoming standardized are collected and interpreted and standard checking lists are prepared. A great deal of the pioneer work in the collection and interpretation of this data has already been done by the Committee and a general educational campaign of standardization and specification is to be undertaken, designed to promulgate the utilization of standards known and tried out. In this work the Congress is co-operating with the American Engineering Standards Committee, the Bureau of Standards of the Department of Commerce, and the Division of Simplified Practice.

The Codes Committee of the Congress has drawn up a code of ethics for the industry which has been widely circulated. The Committee is now considering ways and means of putting this code into active practice, and taking up violations of the code. It is also developing a code of trade practice for the industry.

An important feature of the activities of the Congress is the regular monthly luncheon of the entire membership. At these luncheons the speakers address the members on subjects of interest which are carefully planned beforehand and fit in with the general lines of activity being carried on by the Congress during the period adjacent to the meeting.

The governing body of the Congress is the Executive Committee. It is so organized that it comprises in its membership each of the six constituent elements of the Congress itself, thus making it a fully representative body.

It is obvious from its general scope that the Congress has a large work to perform for the industry. It has already made its start and, especially for the beginning of such a movement, can already point to definite achievements. But the Congress has a large work to perform for the future, and through the co-operation of all its elements it will be able to render an ever-increasing service to the industry from which the public will receive its full share of the benefits secured.

Outstanding Sections in the Code of Ethics

It is unethical:

For anyone engaged in the building industry

A—To unduly or improperly increase the cost of the work or to produce work or workmanship inferior to that contracted for.

B—To falsely or maliciously injure the reputation or business of another.

C—To offer or accept commissions intended to influence sales or contracts.

D—To endeavor to circumvent the fair and reasonable enforcement of building ordinances and safety and sanitary codes.

E—To resort to or countenance "Shopping."

For the owner

A—To call for unnecessary or full estimates on tentative projects, or from unacceptable bidders, or to withhold proper facilities for estimating.

For the contractor

A—To give, knowingly, work or workmanship inferior to that contracted for.

B—To knowingly or carelessly underestimate the value or time of completion of any work.

For labor

A—To restrict the quantity or quality of the output of the individual.

B—To increase cost through arbitrary rules as to number of workmen employed or use of plant and equipment.

C—To deny to any man the opportunity to learn, and when qualified, to practise a trade.

D—To abandon the work pending the decision of disputes between trades.

Development and Manufacture of the Self-Opening Die

Special Correspondence

The first of two articles—The development of the tool—Simplicity of design necessary—Rigidity a very important feature—Accuracy of workmanship essential to success

THOUGH THE self-opening die owes its origin to the bolt and nut business and the first crude examples of the tool were inseparable parts of the machines designed for cutting the threads on bolts and similar articles, it has long ago outgrown its field of early activity and is now an indispensable unit in the equipment of almost every factory engaged in producing metal parts.

From the crude and unwieldy die-operating mechanism of the first bolt-threaders that could be taken out of the machine only by disassembling the latter the device has developed into a self-contained tool of small compass and light weight that is as easily transportable as a box tool, and can be changed from one job to another or from the machine in which it is at work to one at a distant section of the plant or of different type in a comparatively short space of time.

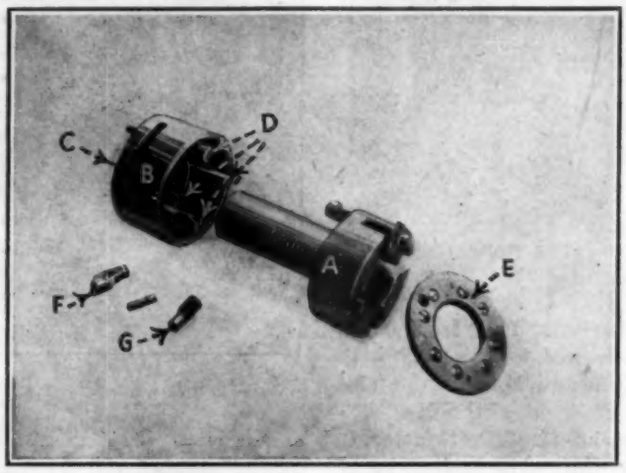

Fig. 1—A 1-in., style A, H. & G. self-opening die; partly disassembled

Condensing, as it were, all of the mechanism that once occupied most of the available space in the gap of a bolt-threading machine into the compact shell of the modern die-head was a job that involved no little engineering skill, for together with its diminishing size came the necessity for greater and still greater rigidity as the demand for accurate and reliable threads increased and the advantages of interchangeability of manufacture became more thoroughly appreciated.

Whereas the original die-head was built into a machine for threading bolts and became a part of that machine, modern bolt-threaders are now built around the die and the latter is by far the most important part of the outfit. Though its use for the purpose of threading bolts has increased far more than has the proportionate demand for bolts, that purpose now represents but a small fraction of its field of usefulness.

With the necessity for interchangeability imposed by modern manufacturing methods the diameter form and pitch of screw threads, wherever and for whatever purpose used, has become a matter of the utmost importance, and no single feature of production has received more careful attention than the means provided for obtaining accuracy in this respect. Speed of production is second in importance only to accuracy of product and, therefore, because the self-opening die-head enables the screw machine to combine speed with accuracy, the development of the one has contributed in no small measure to the success of the other.

For the photographs with which this article is illustrated and for much of the data from which it is compiled, the writer is indebted to the maker of the H. & G. self-opening die, the Eastern Machine Screw Corporation of New Haven, Conn. These tools are made by the above company in a variety of styles and sizes, all involving the same general principles and many of them taking the same chasers, but adapted for use upon various types of machines and different classes of work.

The style A die is the more nearly universal in its application and constitutes by far the major portion of the shop's output; for which reason it has been selected to the exclusion of the others to illustrate the following discussion.

This die is produced in all commercial sizes from ¼ in. capacity to 5 in. in diameter. The nominal size of the die determines within comparatively narrow limits the range of diameters of the screws that can be produced therewith, but the form and pitch of the threads are matters depending entirely upon the chasers, and these latter are so interchangeable that almost any form or pitch of thread may be produced with any die.

All parts of the 1-in., style A, die (except the chasers, the making of which was described in an article on page 169, Vol. 57, of the *American Machinist*) are shown in Fig. 1, where the tool may be seen partly disassembled. Part *A* is the "body," and is one piece with the shank. Part *B* is a unit, though composed

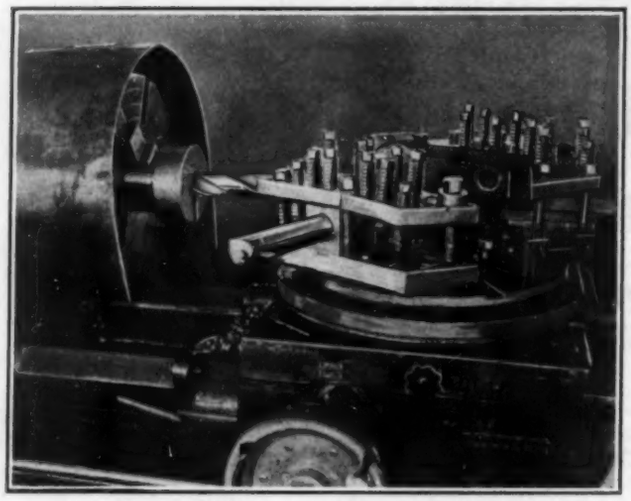

Fig. 2—Die-body in Jones & Lamson machine

of several pieces, and is called the "shell." The "backplate," *C*, is permanently a part of the shell and cannot be removed from it, though up to the time of assembly it has been a separate piece. The four cams *D* are also made permanent parts of the shell in the final assembly

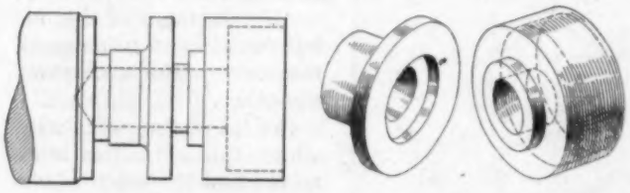

Fig. 3—Shell and backplate as they come from the Cleveland machine

and must not thereafter be disturbed. The "frontplate" *E* remains a separate piece, attached to the body with substantial screws. The trip lever, *F*, and the size adjusting screw, *G*, are shown in front of the die.

The screw machine itself is an important factor in the production of self-opening dies. The bodies, cams,

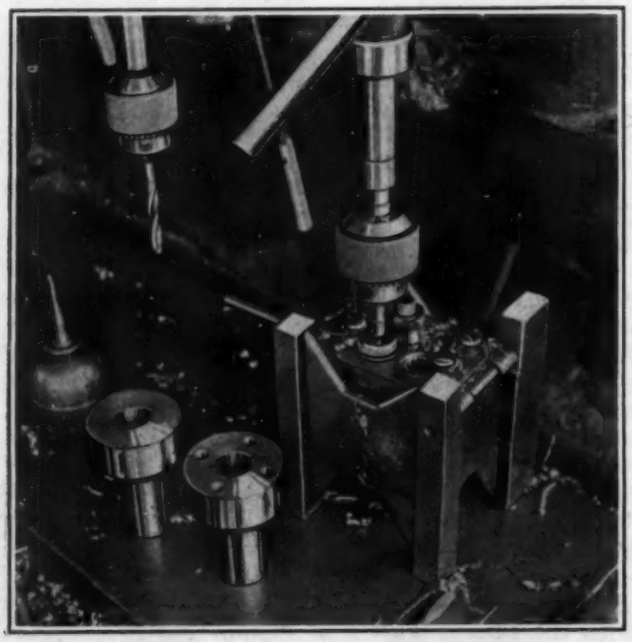

Fig. 4—Drilling the cam-holes in the die body

sleeves, front and backplates, screws and many of the minor details are produced automatically by this means; some of them so nearly complete when they come from the machine that they are ready to go to the hardening department and from thence to the grinding machines upon which they are to receive the finishing touches.

The bodies for the smaller sizes are roughed out on a Cleveland "automatic" and are given a second-turning operation in a Porter-Cable lathe which reduces them to grinding sizes. A Jones & Lamson turret lathe, Fig. 2, is used to make the larger sizes; the demand for which is not so great. All the foregoing are standard operations, performed with the regular tool equipment of the several machines, and need no description.

The shell and backplate are, as before stated, two separate pieces, though they start on the Cleveland machine as one; the machine producing one shell and one backplate at each cycle. The outer diameter is turned on the bar by a tool in the turret at the same time the through hole is being drilled. While the recess is being formed in the shell by the turret tools the

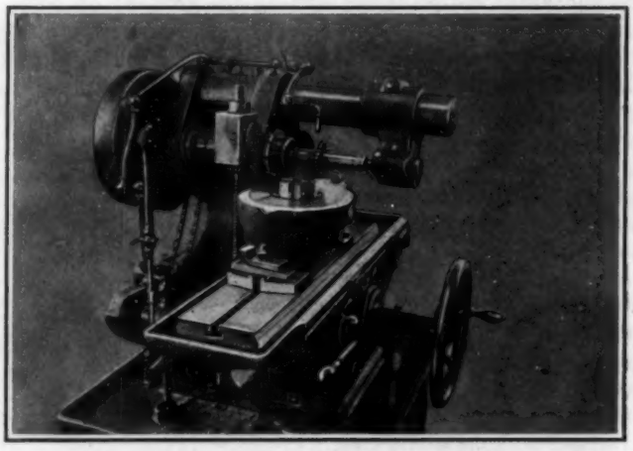

Fig. 5—Milling chaser slots in die-body

tools on the front block of the cross-slide are necking down, close to the holding collet, for the shoulder of the backplate and at the same time another tool of the same group is parting off the shell from the backplate.

The movements are so timed that the shell drops off a few seconds after the recess is completed, exposing the face of the backplate, while the necking tools are still at work on the shoulder. The machine then indexes and the turret brings up a group of tools to make the recess in the backplate, after which this piece is parted off the bar by the regular cutting-off tool at the rear. The sketch, Fig. 3, shows the relation of the two pieces on the bar, and also the shoulder of the shell and the recess of the backplate that are later to be driven firmly together.

Bodies Ground Soft

After the second turning operation has been done on the Porter-Cable lathe the bodies go to the grinding department—though they are not yet hardened—and the shanks are ground to a definite diameter within very close limits, but reduced to finish size. The reason for this apparently out-of-place operation is that in all the jigs and fixtures through which this part is to pass it is held by the shank, which is a light *drive fit* for the hardened steel locating bushings of the various jigs. By this means accuracy of alignment in

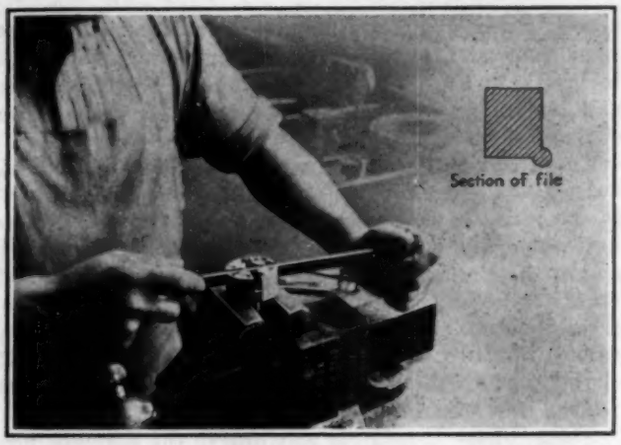

Fig. 6—Filing the clearances at corners of slots for the grinding wheel

all subsequent operations is assured, for by no degree of carelessness or inattention can an operator misplace a piece in such a jig or fixture.

The first of the jigs in which the part is held by driving the shank into a bushing is shown in Fig. 4, where four holes (called the cam-holes) are drilled in the body, parallel to its shank. This is a leaf jig, having the four drill bushings in the leaf, and unless the piece is driven all the way into the holding bushing the leaf will not close. This jig is reversible, and the opposite side carries permanent bushings through which are drilled the various screw and pin holes in what is here shown as the underside of the body.

The location of the cam-holes is very important, as upon their relation to each other and to the centerline

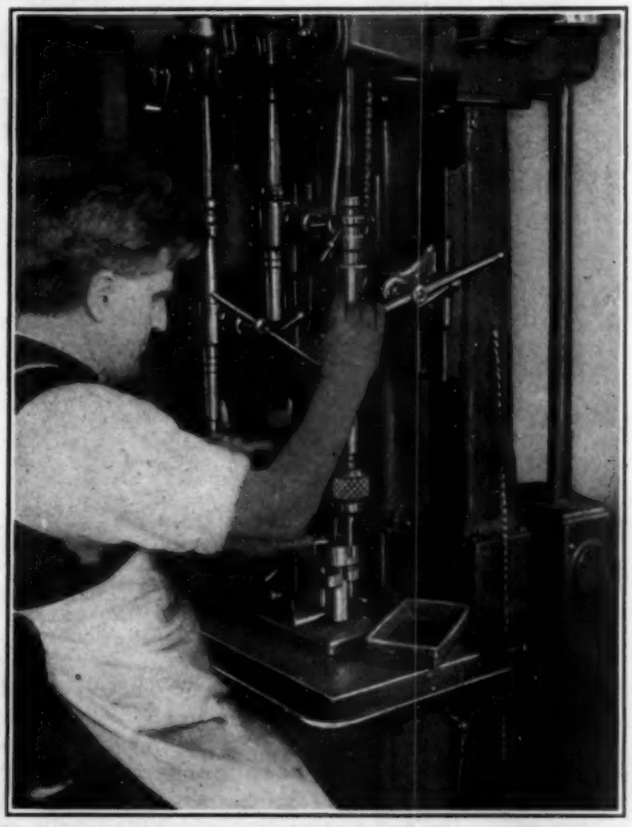

Fig. 7—Lapping the cam-holes in die-body after hardening

of the piece depends in large measure, the accuracy of the finished tool. Therefore, as soon as the first cam-hole is drilled a hardened and ground steel plug is passed into it through the drill bushing, pinning the piece in place so that it cannot possibly turn in the holding bushing while the remaining holes are being drilled. The cam-holes are used as the circumferential locating points in all subsequent operations.

A second drilling operation follows in which eight holes are drilled in the face of the body for the screws that are to hold on the front-plate, and also a hole for the adjusting screw that regulates the exact size of thread that the die will cut. These holes are accurately located by means of a jig that fits over the face and is itself located from the cam-holes. Though there

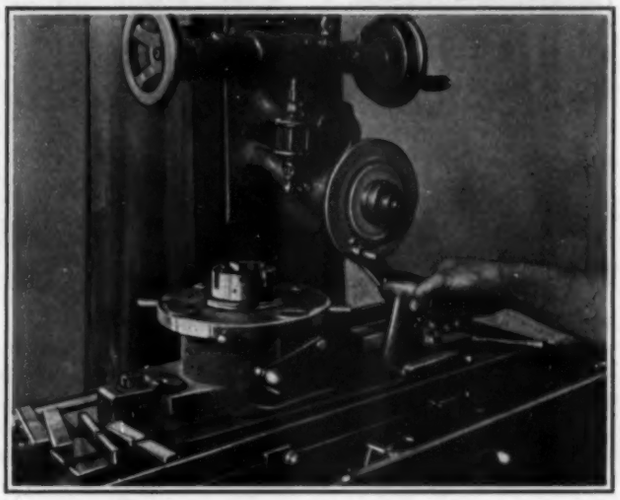

Fig. 8—Fixture for dressing the face of the grinding wheel

is no possibility of error in locating by this means, exact location of these holes is a matter of interchangeability only and bears no relation to the accuracy of the finished die-head.

From the drilling operations the bodies go to the milling machine shown in Fig. 5, where the chaser slots are milled at right angles across the face. It is of utmost importance that these slots intersect exactly at the center of the body and also exactly at 90 deg. and it is one of the most painstaking jobs in the manufacture of the die to make them do so. The slots must also bear a very definite relation to the cam-holes, as each slot cuts away about half the diameter of two holes.

Again the body is located centrally by driving the shank into the bushing of the fixture, and circumferentially by four short plugs that enter the cam-holes from below. The central part of this fixture into which the die-body is driven is rotatable in its housing and provided with an accurate index plate by which the 90-deg. relation of the slots is established.

As the chaser slots are later to be ground on both sides and the bottom, it is necessary to provide clearance at the corners for the grinding wheel. The clearance downward could easily be milled in at the same time and with the same cutters that are used to mill the slots, but this would involve special and expensive cutters that would not in any event mill the sidewise clearance, so that extra operations would be necessary anyway. Instead of going to the expense

of special cutters and an extra milling operation to put in this clearance, it is *filed* in—by hand—even more quickly than it could be milled.

The file is of special section, "safe-edge" on four sides and having teeth only on one projecting corner. Fig. 6 shows the operation. The operator has only to continue filing until the file will cut no longer, when he

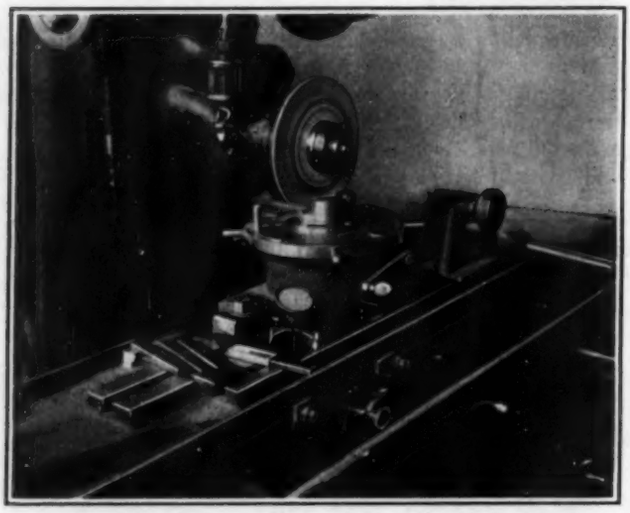

Fig. 9—Grinding the sides of the slots

knows that the groove has reached proper depth in both directions. The file is thus its own gage.

An early operation is the lapping of the cam-holes, shown in Fig. 7, in which operation the piece is held by the shank in a V-block and the holes ground out with a copper lap held in the chuck of a drill press. It differs, however, from a straight lapping operation in that both work and lap are held in parallel planes.

If distortion in the way of departure from parallelism had occurred in the process of hardening, a straight lapping operation in which the work was held in the hand and allowed to float upon the lap would not correct it; the lapped hole would be round and straight, but not necessarily parallel with the shank. The method of holding the work and lap as above described secures the condition of parallelism as well, and should be classed as a grinding, rather than a lapping, operation.

As the experienced mechanic might well suspect, grinding the chaser slots after the body is hardened is a fussy job, and one for which none but expert workmen can qualify. The limit of error, both in depth and width of the slot, is minus 0, plus 0.0005 in.; and this is further complicated by the necessity for having the intersection of the slots exactly upon the center-line—no limit of error allowed. Notwithstanding this arbitrary requirement, and the fact that error in the width or centrality of intersection cannot possibly be retrieved, the percentage of loss is very small. If a slot should be ground a trifle too deep it would be an easy matter to correct it by grinding back the face, but the exact depth of the slot is so much less difficult to attain than is the centrality of intersection that the workman who ground a slot too deep would consider himself guilty of a very elementary fault.

In order to grind the sides of the slots square with the bottom it is necessary to use a wheel the face of which is slightly concave, so that only the extreme corner will touch the work. A saucer-shaped wheel would be right for this purpose, but owing to the necessity for grinding the bottom of the slot at the same time and setting a saucer-shaped wheel cannot be used. In Fig. 8 is shown a diamond-holding fixture and the manner of using it to dress the face of an ordinary 6-in. disk wheel.

The arm, at the end of which the diamond is held, swings in a vertical plane almost, but not quite, parallel to the plane of the wheel. The base of the fixture is adjustable, and is turned so that the plane of the wheel and of the circle in which the diamond swings intersect at a very slight angle. Thus, as the diamond rises from its first point of contact with the wheel it also moves inward with respect to the face; leaving it slightly hollowed, or dished. This dishing is not more than a few thousandths of an inch.

The die-body is held for grinding in the same manner as in the previous operations, by driving the shank into the locating bushing of the fixture and bringing the slot into circumferential relation with the index plate of the fixture by setting the four cam-holes over corresponding plugs in the latter.

The face of the wheel, only, is used to grind the sides of the slots—never the back. The holding fixture is rotatable and locks in four positions by means of a latch and index plate, upon the accuracy of which the parallelism of the slots and the angle of their intersection depends. The operator allows the table of the grinding machine to traverse back and forth until the wheel ceases to cut, when he turns the fixture 180 deg. and repeats the process without disturbing the setting of the wheel. In this manner he can be assured that if the rotatable holding bushing is true the slot must cut exactly across the center of rotation.

He does not take any chances, however. Two sets of gages are provided, and if the first set shows error he still has 0.001 in. in which to search out the cause and correct the result. Fig. 9 shows the wheel in the work and Fig. 10 the application of the dial gage to

Fig. 10—Testing the centrality of the slots

determine the centrality of the slot. The V-shaped under-surface of the gaging block bears at two points upon the accurately ground circumference of the die-body and the measuring point of the indicator contacts with the side of the hardened and ground parallel piece (the first no-go gage) which fits tightly in the slot. The indicator is applied first to one side and then to the other and the readings must be identical.

Heat-Treatment of Steel Gears

By Joseph Kaye Wood
Consulting Engineer

Ideal requirements for gears modified by conditions of commercial manufacture—Materials for gears—Heat-treatment of various steels—Quench-hardening

THE HEAT treatment of gears, like that of springs, has become a very important function in the combined effort of the metallurgist, machinist, and heat-treater towards producing a transmission element that will meet the very exacting service required in the automotive, railway, turbine and other industries of today. This phase of gear manufacture, besides involving nearly every branch of the working of metals, requires a strict observance of good kinematical design, a lack of which in the past has caused considerable trouble and expense.

The ideal requirement of gears is that they will transmit a given amount of power by a multiple cantilever action, the point of application of the load rolling progressively from tooth to tooth over their arcs of contact, at a constant velocity ratio and at one hundred per cent efficiency. This requirement to be practical must be modified in accordance with conditions of commercial manufacture and maintenance.

Lack of attainment of the kinematic ideal produces a sliding action in addition to rolling, the combination of the two resulting in considerable friction and a greater tendency of the teeth to wear. Two types of tooth profiles have been developed to eliminate this tendency as far as possible, namely, the 20-deg. involute stub form, in which the pitch point varies with the distance between mating gear centers; and the enveloping tooth form, which reduces the sliding action to a minimum. Pitch variations give rise to impact vibrations, some of which are within the range of frequencies that emit characteristic noises. In addition to calling for a gear having sufficient strength to transmit the maximum load at the highest speed and a high resistance to rolling friction wear with lubrication, the modified requirement will necessitate a high resistance to sliding friction wear, with or without lubrication; a sufficient impact and fatigue strength; toughness; and, in exceptional cases, a certain degree of flexibility with a damping characteristic to take care of suddenly applied loads and eliminate noise.

Wear Resistance and Toughness

Wear resistance and toughness do not go hand-in-hand in the case of metals, hence it has been the practice, and is now to a certain extent, to case-harden a low-carbon steel gear so as to obtain a file-hard shell of 0.9 per cent carbon steel $\frac{1}{32}$ in. thick, and a core of soft but tough fine-grained, low-carbon steel. This fabrication of the desired properties of hardness and toughness is ideal for gears except under certain conditions of manufacture and service, such as in automotive transmission drives where they are intermittently clashed in and out of mesh, sometimes unmercifully. With such abuse the case often chips off, leaving soft metal exposed to friction and wear and soon weakening the tooth to the point of fracture by impact. With the advent of alloy steels and the necessary high-speed tools to cut them, it was found that by simply quench-hardening the gears uniformly throughout, a combination of hardness yielding to the file with great toughness was obtained. This combination was more capable of meeting the demands of the present day, particularly in the automotive industry where size and weight are important.

Variations in Processing Affect Product

Variations in the processing of the materials going into gears cause considerable trouble and further prevent the realization of a product meeting the ideal requirements. For example, lack of homogeneity and poor grain structure occurring in forgings which are not properly annealed will cause pitting and flaking, while segregation of hard constituents, such as cementite, will cause hard spots that the machine cutter passes over, leaving incorrect profiles. Both of these defects may be accentuated by poor heat treatment and will give rise to periodic vibrations accompanied by characteristic noises. Gears made from bar stock are not so objectionable from the standpoint of inherent defects as gears made from forgings, because the orientation of the metal "grain" in the gear blank will have some effect on the strength and wearing characteristics of the teeth, as well as on the distortion of the gear due to heat treatment. Perfectly smooth tooth surfaces, which are highly desirable where wear is concerned, are not usually obtained. The nearest approach to the ideal is found in the novel method of rolling gears while hot, which will bear watching with interest. Grinding also produces good surfaces, although this process is primarily intended to correct the distortion of certain steels due to heat treatment.

The foregoing statements regarding the nearest possible approach to the ideal requirement, may be summed up as follows:

1—An accurate kinematic profile and a gear design that will give an equal distribution of stress, particularly as regards sharp angle and permanent press fit stresses.

2—Sufficient strength, toughness and elastic quality to maintain the accuracy of the tooth profile under all conditions of loading, such as static, impact, fatigue, etc., that are liable to occur in the particular gear service anticipated.

3—Sufficient resistance to wear, from both rolling and sliding friction, to maintain the accuracy of the tooth profile for the service intended.

The fulfillment of these requirements presupposes homogeneous materials, uniformity of pitch, accurate tooth profile, good surface condition, and proper heat treatment to give the desired microscopic structure and freedom of the gear from distortion. In accordance with these modified requirements manufacturers are producing gears from 95 to 98 per cent efficient as transmission elements of mechanical power, and which are holding their tooth profiles against wearing influences, although protected by lubrication. They are not always silent, however.

Eliminating very small gears from consideration, cast iron stressed to a maximum of 1,800 lb. per sq.in. is used for light work, with tangential speeds up to 2,000 ft. per min. For medium duty, gear wheels of cast steel or possibly cast iron with mating pinions of case-hardened forged steel or high-strength phosphor-bronze may be used. If the absorption of impact shocks and silent running are desired, pinions of fiber, rawhide or bakelite are used. A leaded phosphor-bronze pinion is good from the standpoint of wear.

Gears for Heavy Duty and High Speeds

For heavy duty and high tangential speeds high-grade cast-steel wheels and "special" alloy-steel pinions, both case-hardened and quench-hardened, are used and very often, where space limitations and low weight govern, both mating gears are made from quench-hardened alloy steels. For very high speeds up to 10,000 ft. per min., a change from spur to very accurate helical gears is required, in addition to the use of alloy steels. In this article, we shall be concerned chiefly with the heat treatment of gears made from "ordinary" carbon steels and "special" alloy steels, recommended by the American Gear Manufacturers Association.

The carbon content in all steels of both these general classes ranges from 0.1 to 0.6 per cent, being from 0.10 to 0.25 per cent for case-hardening treatment, about 0.25 to 0.35 per cent for untreated steel, and from 0.35 to 0.60 per cent for quench-hardening treatment. Of course, upon case-hardening, the carbon content in the case is raised to about eutectoid composition for a limited depth. These steels are refined by the open-hearth process and sometimes by the electric process, the maximum content of the phosphorus and sulphur being between 0.04 and 0.05 per cent. The manganese content varies from 0.3 to 0.8 per cent. The steel comes to the gear manufacturer in the form of rolled or forged blanks.

The "special" or alloy steels contain, in addition to the above constituents, one or two of the following elements: (1) Nickel, (2) chromium, (3) vanadium, (4) silicon, (5) additional manganese. The group of steels in which the above elements are present is composed of nickel steel, chrome steel, chrome-nickel steel, chrome-vanadium steel and silico-manganese steel.

The advantages of these special steels over carbon steels are, as stated previously, higher tensile strength, greater toughness, due to a greater elongation per given hardness, and finally, ease in hardening that results in a more homogeneous product. They have the disadvantage in some cases, however, of being subject to surface defects on cooling during forging or heat treating, due to hardening too easily.

Nickel Steel—The nickel content in this steel varies from 3.25 to 3.75 per cent, which is sufficient to add considerable strength and hardness, particularly in the quench-hardening steel of about 0.4 per cent carbon content. This steel is used for high-speed, heavy-duty turbine pinions.

Chrome Steel—The chromium content in this steel varies from 0.8 to 1.1 per cent and is better than nickel because of easier absorption of carbon and also because it does not tend to laminate, a condition that causes the teeth to flake in service. The carbon content for case-hardening purposes should be about 0.2 to 0.25 per cent to avoid brittleness and, for quench-hardening, about 0.45 to 0.55 per cent. Like nickel, chromium strengthens steel, and has the added advantage of doing so without decreasing the ductility. Furthermore, with this steel it is possible to produce a very homogeneous structure that is remarkably free from distortion after proper heat treating, particularly in the case of the quench-hardening type.

Chrome-Nickel Steel—Probably the best results for gears of all-around service can be obtained with this material, since it combines the good properties of both nickel and chromium. It will, however, harden to a notable degree in air, sometimes causing difficulties by the presence of surface hard spots. The chromium usually varies from 0.45 to 1.75 per cent and the nickel from 1.0 to 3.75 per cent, while the carbon content varies from 0.1 to 0.5 per cent, the lower part of the range being employed in case-hardening steels. For Maag involute and electric traction gears a steel with 0.5 per cent chromium, 1.5 per cent nickel, and 0.4 per cent carbon is sometimes used, giving a tensile strength of 125,000 lb. per sq.in., 9 to 12 per cent elongation, and a Brinell hardness of about 280 when heat-treated.

Chrome-Vanadium Steel—Small amounts of vanadium will produce the same strength as large amounts of chromium. Thus we have steels containing as little as 0.15 per cent vanadium and from 0.8 to 1.1 per cent chromium, with the usual gear range of carbon and manganese content. The physical properties due to heat treatment of this steel deteriorate very rapidly with increase in size. A 5-in. chrome-vanadium pinion is inferior to a chrome-nickel pinion of the same size.

Silico-Manganese Steels—Additional manganese, like chromium but unlike nickel, accelerates the case-hardening of steel, giving a case of greater depth. This steel contains about 1.8 to 2.2 per cent of silica, 0.6 to 0.9 per cent manganese, and is used to some extent for gears when quench-hardened.

Machining Methods for Gears

Upon receiving a gear blank from the steel mill it is first annealed at the proper temperature, particularly if it is a forging, in order to refine the grain structure and to render it machinable. A Brinell hardness ranging from 155 to 180, depending upon the composition, is suitable. The blank is then rough-machined, after which it may be heat-treated and ground, or it may be given the finish-machining followed by the heat treatment. The first method is more accurate and economical, unless the steel does not distort appreciably when heat treated, like chrome steel for example. The second method needs the provision of elaborate means for restricting heat distortion by suitable clamping, and uniform heating of unequal sections.

Roughly milled surfaces, as well as distortion, are objectionable after hardening, because such a surface acts like a cutter on the relatively soft steel of the mating gear wheel. Tests carried out on different types

of spur gears used in electric railway traction have been reported as follows:

	Life of Pinion	Life of Wheel
Pinion unhardened engaging cast steel wheel.....	50,000 miles	95,000 miles
Pinion hardened but not ground	75,000 "	75,000 "
Pinion hardened and accurately ground	300,000 "	300,000 "

Annealed, rough-machined gears made from steel with low carbon content are case-hardened in the following manner: The gear is packed in a box containing the carbonizing material, preferably about 60 per cent charcoal and 40 per cent barium carbonate, and then heated uniformly to the proper temperature. The next step in the old practice was to quench the gear from the box and, if done properly, this would prevent the formation of a cementite network and large grain growth. If cooled in the box, the distortion was less but, of course, the grain size was large. Hence, the present-day practice is to cool the gear slowly in the box and then reheat to a temperature lower than that for carbonizing, but above the critical range. This method refines the core and has a beneficial effect on the case. Good practice also concludes with a drawing process.

The heat treatment of various S.A.E. steels, as recommended by the American Gear Manufacturers Association, are as follows:

S.A.E. 1020—Low-Carbon Steel. This steel, which has 0.15 to 0.25 per cent carbon and 0.3 to 0.6 per cent manganese, when hardened as indicated below is used for gears of heavy section. The properties obtained are: tensile strength 80,000 lb. per sq.in.; yield point, 50,000 lb. per sq.in.; elongation, 20 per cent; and a reduction of area equal to 60 per cent.

1—Normalize at 1,650-1,750 deg. F.
2—Carburize at 1,650-1,700 deg. F.
3—Cool in box
4—Reheat to 1,600-1,650 deg. F.
5—Quench in water at 110 deg. F.
6—Reheat to 1,400-1,450 deg. F.
7—Quench in water at 110 deg. F.
8—Draw at 250-500 deg. F.

S.A.E. 2315—Low-Carbon Nickel Steel. This steel has the addition of from 3.25 to 3.75 per cent nickel and is heat-treated as follows:

1—Normalize at 1,650-1,750 deg. F.
2—Carbonize at 1,600-1,650 deg. F.
3—Cool in box
4—Reheat to 1,500 deg. F.
5—Quench in oil
6—Reheat to 1,350-1,400 deg. F.
7—Quench in water
8—Draw at 250-500 deg. F.

S.A.E. 3115—Low-Carbon Chrome-Nickel Steel. Contains 0.45 to 0.75 per cent chromium and 1.0 to 1.5 per cent nickel. When hardened as described below, it gives a tensile strength of about 150,000 lb. per sq.in. at the 500-deg. draw.

1—Normalize at 1,650-1,750 deg. F.
2—Carbonize at 1,625-1,675 deg. F.
3—Cool in box
4—Reheat to 1,525-1,575 deg. F.
5—Quench in oil
6—Reheat to 1,375-1,425 deg. F.
7—Quench in oil
8—Draw at 250-500 deg. F.

S.A.E. 3312—Low-Carbon Chrome-Nickel Steel. This steel contains a maximum carbon content of 0.17 per cent, 3.25 to 3.75 per cent of nickel and 1.25 to 1.75 per cent of chromium. It gives a tough core of high strength, when heat treated as follows:

1—Normalize at 1,600-1,700 deg. F.
2—Carbonize at 1,600-1,650 deg. F.
3—Cool in box
4—Reheat to 1,525-1,575 deg. F.
5—Quench in oil
6—Reheat to 1,375-1,425 deg. F.
7—Quench in oil
8—Draw at 250-500 deg. F.

S.A.E. 6120—Low-Carbon Chrome-Vanadium Steel. Contains a minimum of 0.15 per cent vanadium and 0.8 to 1.1 per cent chromium.

1—Normalize at 1,650-1,750 deg. F.
2—Carbonize at 1,650-1,700 deg. F.
3—Cool in box
4—Reheat to 1,600-1,650 deg. F.
5—Quench in oil
6—Reheat to 1,425-1,475 deg. F.
7—Quench in water
8—Draw at 250-500 deg. F.

In quench-hardening gears the blanks are, of course, given a preliminary annealing to relieve the forging and rolling stresses and also to make them machinable able to the extent of about 180 Brinell hardness. They are then cleaned in an acid bath previous to the rough machining of the teeth and bore. If the steel is of the non-distorting type the gears are then given the finish cuts previous to the hardening quench. With most steels, however, the teeth will have to be given the finishing cuts on the grinding machine after the hardening quench, in which case they are placed on a revolving disk in an electric furnace regulated to the correct quenching temperature. The disk is slowly revolved by mechanical means to insure a uniform temperature around the entire circumference of the gears. The latter must be kept in the oven long enough to be uniformly heated throughout, but it does not matter how long this soaking takes place, provided the temperature is not raised further and the furnace has a reducing atmosphere.

The Hump method of heating the gears to above the critical range is used very largely in the automotive industry, since it offers a control suitable for large production work. The next step is to allow the gears to cool while in the furnace and, upon assuming room temperature, they are machined to finish dimensions. If they are to be ground, they are quenched in oil. Assuming that they are not to be ground, they are reheated to above the critical range and then quenched in oil. The final operation is to draw the temper of the gears in a salt or lead bath. The quenching oil tank should have a suitable steam circulating pipes for use in winter and a similar cool water circulating system for summer use, in order to keep a constant oil temperature of about 120 deg. F.

The quench-hardening of various S.A.E. steels, recommended by the American Gear Manufacturers Association, is as follows:

S.A.E. 1045—Carbon Steel (0.4-0.5 per cent carbon). It is possible to obtain a tensile strength of about 130,000 lb. per sq.in., and a Brinell hardness of about 300 with the following heat treatment:

1—Normalize at 1,600-1,700 deg. F.
2—Reheat to 1,400-1,450 deg. F.
3—Cool in furnace
4—Machine
5—Reheat to 1,475-1,525 deg. F.
6—Quench in water
7—Draw at 250-500 deg. F.

S.A.E. 2350—Nickel Steel (0.45–0.55 per cent carbon). This steel contains from 3.25 to 3.75 per cent nickel and is suitable for gears of large section when heat treated as follows:

1—Normalize at 1,600-1,650 deg. F.
2—Reheat to 1,375-1,425 deg. F.
3—Cool in furnace
4—Machine
5—Reheat to 1,400-1,450 deg. F.
6—Quench in oil
7—Draw to required hardness

S.A.E. 3250—Chrome-Nickel Steel (0.4–0.5 per cent carbon). Since this steel, containing 1.5–2.0 per cent nickel and 0.9–1.25 per cent chromium, permits of deep penetration in oil-quench hardening, it is desirable for gears of heavy section and, in view of its importance in this respect, the forged blanks are made from the highest quality electric steel. At a drawing temperature of about 500 deg. F. and a Brinell hardness of 415, it is possible to obtain a tensile strength of 250,000 lb. per sq.in. and a yield point of 200,000 lb. per sq.in. The S.A.E. treatment is as follows:

1—Normalize at 1,600-1,700 deg. F.
2—Reheat to 1,250-1,300 deg. F.
3—Cool slowly in furnace
4—Machine
5—Reheat to 1,400-1,450 deg. F.
6—Quench in oil
7—Draw to required hardness

S.A.E. 6150—Chrome-Vanadium Steel (0.45–0.55 per cent carbon). Greater strength for a given carbon content can be obtained with this steel than with a low chrome-nickel steel, although it will probably not be as good from the standpoint of other physical properties. For gears of heavy section heat treat as follows:

1—Normalize to 1,650-1,700 deg. F.
2—Reheat to 1,250-1,350 deg. F.
3—Cool slowly in furnace
4—Machine
5—Reheat to 1,425-1,625 deg. F.
6—Quench in oil
7—Draw to suitable hardness

S.A.E. 3450—Special Chrome Steel (0.47–0.53 per cent carbon). This steel contains 0.80 to 1.10 per cent chromium and is notably free from distortion due to heat treatment. Therefore, it need not be ground under normal circumstances. The heat treatment is as follows:

1—Normalize at 1,525-1,575 deg. F.
2—Reheat to 1,700 deg. F.
3—Quench in oil
4—Draw in a salt bath to about 900 deg. F.

S.A.E. 9260—Silico-Manganese Steel (0.55–0.65 per cent carbon). This steel contains from 0.60 to 0.90 per cent manganese and 1.8 to 2.2 per cent silicon. It is used to some extent for gears and is heat treated as follows:

1—Normalize at 1,650-1,750 deg. F.
2—Reheat to 1,400-1,450 deg. F.
3—Cool slowly in oven
4—Machine
5—Reheat to 1,600-1,650 deg. F.
6—Quench in oil
7—Draw in salt bath

Although the manufacture of gears in accordance with the modified requirements outlined by the Society of Automotive Engineers and recommended by the American Gear Manufacturers Association seems to be a very difficult problem, a commercial product equal to any can be realized. Accurate methods of control in machining and heat treating are needed.

A Metric "Milestone" or "Tombstone"?

BY FRANK C. HUDSON

Nearly all people who are interested either for or against the introduction of the metric system are under the impression that the agitation is of comparatively recent origin. Few seem to be aware that the superintendent of one of the well-known railroads of fifty years ago, became so badly inoculated with the metric malady as to plant stones every kilometer along his roadway.

This was on the old Boston & Providence R.R., which is now part of the New York, New Haven & Hartford system. There seems to be no record of the exact date of the erection of these stones, but it was probably in the late 60's or early 70's.

Tombstone of a metric enthusiast

The illustration shows one stone that has been desecrated with a figure 8 to indicate its distance from South Station, Boston. In spite of this desecration, however, it is still easy to read Prov. 64 km., and 39.77 m., indicating that the stone was originally 64 km. from Providence, which is not very far from the location in which the photograph was taken some twelve or fifteen years ago, while on a trip through New England.

The 39.77 m. (miles) was evidently a concession to those who were backwoodsy enough to still think in English measure, and it shows very clearly what sort of decimals we get into when we begin translating from one system to the other.

No one seems to know, or care, just when the scheme was abandoned, and the stones altered to designate miles instead of kilometers. It is something of a problem to know whether to designate the stones as English milestones, or as tombstones in memory of a departed metric enthusiast.

Five Per Cent Nickel-Steels

Circular No. 100 of the Bureau of Standards says that five per cent nickel-steel (S. A. E. 2,500 series) containing about 0.12 per cent carbon, is used particularly for casehardening where the requirements are severe, such as on rear-axle pinions with spiral bevel-teeth. It requires only a very low heat-treating temperature (750 deg. C. or 1,350 deg. F.) and may be air-hardened, thus reducing to a minimum the amount of warpage.

A similar steel containing 7 per cent of nickel has also been used, particularly abroad, as an air-hardening, carburizing steel.

Automotive Production

Pierce-Arrow Machining Processes

By John Younger
Associate Editor, *American Machinist*

Machining cylinders, crankcases and brake drums — Rotary milling fixtures and continuous progressive methods — Use of target fixtures in proportioning material

PRODUCTION in the Pierce-Arrow plant has never been considered to be what is commonly called volume-production, and it is particularly interesting to study some of the methods that are in use in the manufacture of the latest product, the model 80 car. The new model will be sold to a class larger than the company has catered to in the past and it is expected that the production will be increased correspondingly. Methods have therefore been altered in the machine shop, the changes centering around the engine, particularly the heavier units, the cylinder block and crankcase.

The cylinder block is a gray-iron casting which is tested for leakage with a water pressure of from 80 to 100 lb. per sq.in. The scleroscope reading on the machined surfaces must be from 25 to 30, with a corresponding Brinell hardness from 130 to 150. Each cylinder block is tested to these standard and is rejected for failure to pass.

The first operation in the machine shop is to place the block on what is called a target fixture, which lines up the material to the best advantage to insure that the surfaces will be machined cleanly. The first actual machining operation is shown in Fig. 1, where the blocks are placed on the Newton continuous rotary milling machine in which they are roughed and finished on the top and bottom at the first station and milled on the sides at the second station, 0.005 in. being left on top for finishing and grinding.

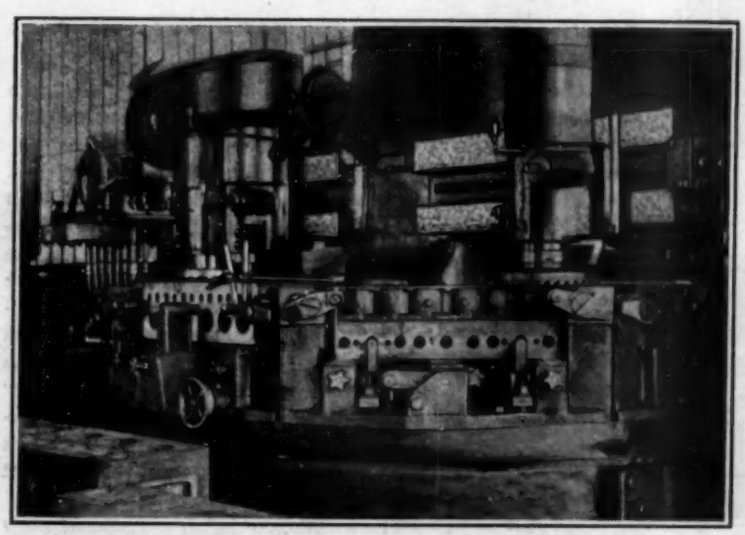

Fig. 1—Milling cylinder blocks in Newton machine

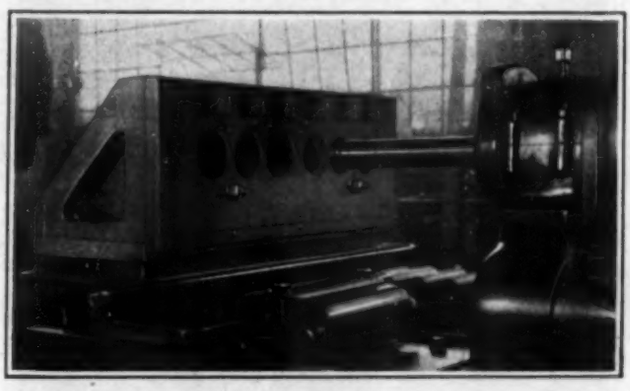

Fig. 2—Grinding one cylinder at a time on Heald hydraulic-type machine

In the next machining operation the stud-holes are drilled on Baush multiple drills and two of the holes are reamed for locating purposes. This advances the block to the first boring of the cylinder itself which is done on a Foote-Burt machine of the usual type. From 0.05 to 0.06 in. of the diameter is left for subsequent operations. On another of the Foote-Burt machines the second boring operation is performed, about 0.025 in. of metal being removed. The third boring immediately follows, on the same machine, and 0.01 in. is left for grinding. It has been found more economical to bore a quantity of cylinders in the second operation, stacking them alongside the machine,

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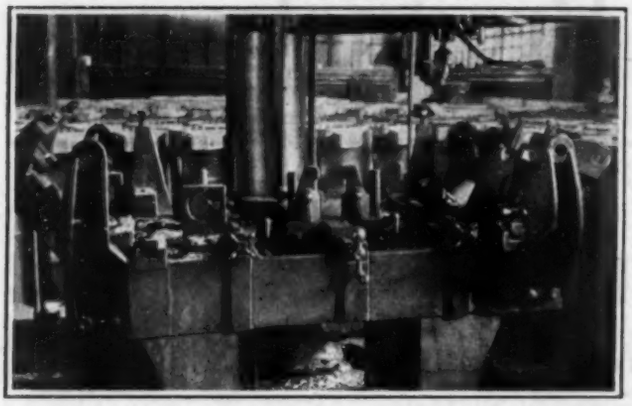

Fig. 3—Empty target fixture for crankcase

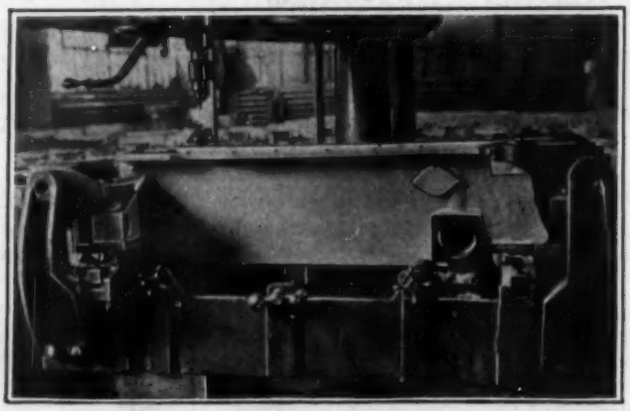

Fig. 4—Target fixture with crankcase in place ready for locating holes to be drilled

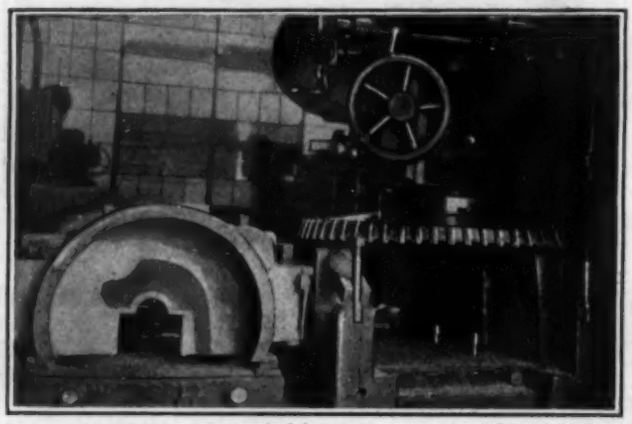

Fig. 5—Milling cylinder-block face on crankcase with 60-tooth cutter

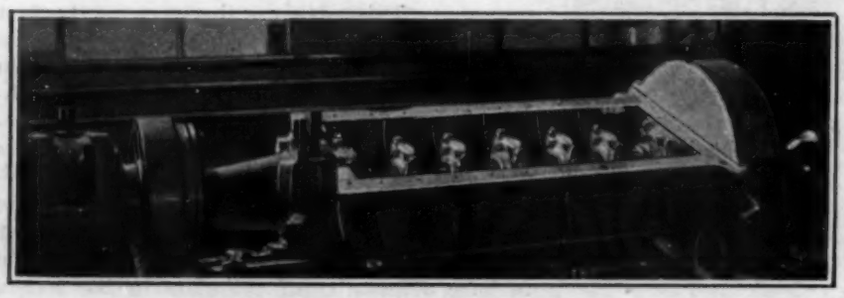

Fig. 8—Facing timing gear cover and bell housing in an engine lathe

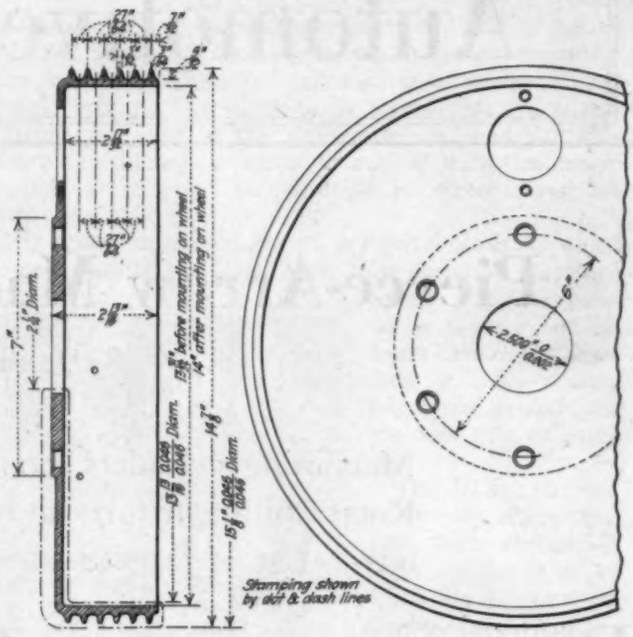

Fig. 9—Rear wheel brake drum

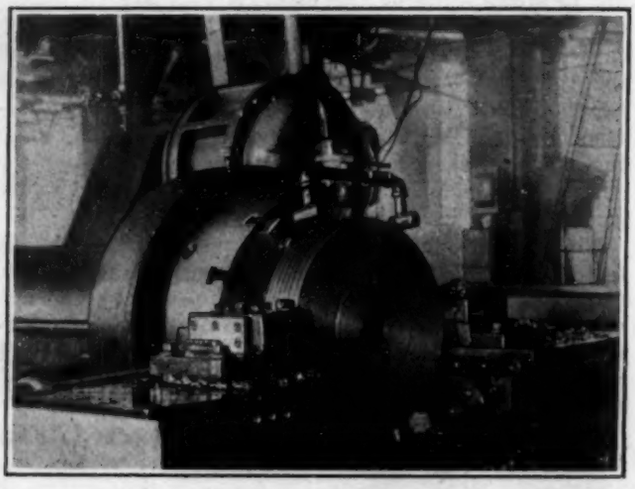

Fig. 10—Grooving brake drums in Gisholt Simplimatic

and then to change the cutters and finish-bore from the stack. The bores of the cylinders are not ground until after several other machining operations are performed, among them chamfering, reaming, drilling and tapping. The twenty-first operation is grinding the top to a smooth surface, and it is followed by the operation of grinding the bores of the cylinders on a Heald No. 50 hydraulic-type machine. The top surface is placed against an angle fixture as shown in Fig. 2, and one cylinder bore is ground at a time. This operation completes the cylinder block with the exception of subsequent washings and inspections.

The crankcase is an aluminum casting. There is shown in Fig. 3 a

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target fixture used to proportion the stock on the crankcase to insure clean machining. The case is placed in this fixture, as shown in Fig. 4, and four locating spots are drilled and faced. These locating spots, used throughout the processes, are aided by the two end cylinder-opening holes, which are bored and reamed to a small tolerance. The first big machining operation, performed on an Ingersoll milling machine of the planer type, is the first milling of the cylinder surfaces. From 0.02 to 0.03 in. is left for final milling. The oil pan-joint surface and the bearing-cap surfaces are milled on the same machine, using a 60-tooth milling cutter as shown in Fig. 5. The ends of the

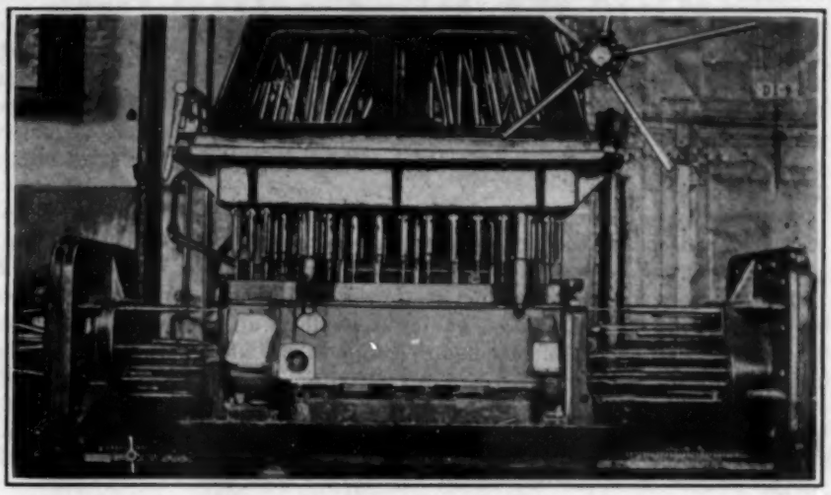

Fig. 6—Baush 78-spindle drilling machine at work on crankcase

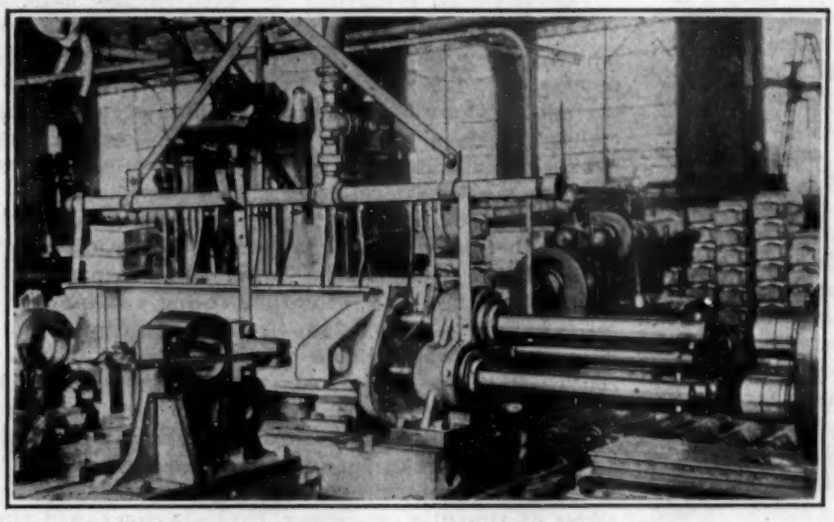

Fig. 7—Boring crankcase on Rockford machine

bearings are then milled, using a multiple, straddle-milling bar, after which several drilling operations take place, including the one shown in Fig. 6, where the stud holes and others are drilled on a three-way Baush machine of 78 spindles. Thence, the machining goes to the machine shown in Fig. 7 where the crankshaft and camshaft bearings are bored and reamed, the distributor and idler-shaft housings are drilled and the camshaft, distributor and idler housings are faced. The machine is a Rockford crankcase boring machine.

One method, which is very simple but somewhat unusual, is that shown in Fig. 8. The operation is that of facing the timing-gear cover and the bell housing. The crankcase is mounted on an arbor which extends through the crankshaft bore and the machine used is an engine lathe.

The Pierce-Arrow rear-wheel brake drum is illustrated in Fig. 9. The steel is 40 to 50 carbon and very tough. Machining is done in six Gisholt Simplimatic machines, one of which is illustrated in Fig. 10. On the first machine the inside is rough-bored and faced; on the second it is rough-faced on the outside and turned; on the third and fourth the external grooving is completed. Two machines are found necessary on this part of the work to maintain the schedule of production. On the fifth machine the drum is finish-turned and the hole is bored; on the sixth the face is finished and the brake-drum surface is bored. In addition to the operations on the Simplimatic machines there is an operation of finish-boring the brake surface when the drum is assembled to the wheel. This final finish trues up the brake surface with the bore of the hub. All of the Simplimatic machines are grouped together and are run by two men.

Many other efficient, well-planned machining operations might be described in connection with this new model. What has been discussed, however, shows that the new car is being produced on up-to-date machines built to give accurate results.

Abstracts

from other publications

General Motors Proving Ground

A large force of men have been at work for some time on the General Motors Proving Ground near Milford, Mich. This tract is convenient to the principal General Motors car and truck plants located at Detroit, Lansing, Flint and Pontiac, all of which are less than 50 miles distance. Approximately 1,125 acres are included in the area. The terrain embraces a level valley and adjacent hills, rising 250 ft. above the valley floor.

The primary purpose of this ground is to provide road conditions of various types and other facilities for making road tests of motor vehicles.

One section of concrete road 20 ft. wide is 5,114 ft.

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long, absolutely level and straight, with graveled loops at each end for turning around. This will be utilized in making acceleration and fuel economy tests. Its eventual length will be 1¾ miles. Some roads give long grades, 7.1 per cent and 10 per cent and there is one road about a quarter of a mile long with a grade of 11.6 per cent.

A garage building 60x200 ft. has already been erected and is being equipped for making necessary repairs and adjustments. Another building will provide living quarters for the personnel stationed permanently on the proving ground. The organization will be under the supervision of F. M. Holden.—*Automotive Industries*, Sept. 18, p. 531.

Involute Gear Teeth

This article is too mathematical to abstract with any degree of satisfaction. It deals with some notes on the interference, undercutting, and conditions of contact in spur gears. It states that in the various systems in use attempts are made to avoid interference either by modifying the tooth shapes or undercutting the teeth. There still remains the fact, however, that something further must be done to get the maximum contact surface in order to obtain silence and reduce wear to a minimum. This can only be secured if interference be avoided by methods other than that of undercutting or correcting the tooth curves, providing the involute system is to be maintained. These are; (a) shortening the teeth, (b) increasing the pressure angle, (c) correcting the addenda and dedenda. Gears with modified addenda and dedenda may be generated with standard rack cutters or by the Fellows pinion generating system, but under no consideration should a form cutter system such as Brown & Sharpe be used for producing gears with corrected teeth heights.—*The Automobile Engineer*, Eng. Aug. p. 237.

Hardness of Metals

T. V. Buckwalter, chief engineer of the Timken Roller Bearing Co., contributes a discussion of the improper use of the term "hardness" when what is really meant is resistance to wear.

The principle reason that an article is hardened is to resist wear, and the value of an article often depends on its properties of resistance to wear. Therefore this resistance in the last analysis is the proper measure of the value of hardness. It is recognized that wear tests will furnish the most accurate determination as to those properties of steel that enable it to resist wear. Rebound measuring devices and penetration-measuring systems are valuable to the extent that the readings derived therefrom bear definite relation to resistance to wear.

It can further be stated that the scales of arbitrary numbers on our hardness-indicating systems are out of all proportion to the true measure of hardness. For instance, in a certain case the scleroscope reading of soft steel shows a hardness of 30 and of hardened steel a hardness of 90, yet a tool of the hardened steel will remove by cutting an amount of metal of the soft-steel out of all proportion to weight as compared to loss on the hardened steel tool, measured by wear of the tool. Therefore, it can be truthfully stated that the steel tool is not only three times as hard as the soft steel, but is millions of times harder. In commenting on this article, the editor states that there are some cases where an article is not necessarily hard to resist wear, as for example, in phosphor bronze, where particles of extremely hard copper phosphide are distributed through a soft matrix of metallic copper. It is difficult in this case to state which of the two constituents, the hard or the soft, contribute most to the wear resistance of the bearing. It is also added that until a definite physical conception of hardness has been established and universally adopted the use of the term hardness should be abandoned and we should speak in terms of Brinell numbers, scleroscope numbers rather than Brinell hardness or scleroscope hardness. —*Mechanical Engineering*, Sept., p. 564.

Bearing Metals

The physical properties of anti-friction bearing metals, according to P. W. Priestley, do not appear to have received the attention of investigators that they deserve. During recent years a number of highly important metallurgical investigations have been made by eminent workers, and the data recorded forms a very admirable and necessary contribution in proceeding to examine the mechanical properties of these alloys.

In connection with the success application of anti-friction bearing metals, it appears urgently necessary to establish a commercial form of mechanical test applied particularly to the durability and wearing properties. Such a test might indicate a definite unit-property and would prove of extreme value to those concerned in the design, construction and application of machinery incorporating anti-friction metal bearings.

Satisfactory results are obtained with the binary alloys of copper-tin, tin-antimony, and lead-antimony, but even better results are obtained from the ternary alloys of tin-antimony-copper, tin-lead-copper, and tin-antimony-lead. Unfortunately, the ternary alloys have not been thoroughly investigated, but it is considered that the tin-antimony-copper mixtures are at the present stage most successful.

Mr. Priestley gives tables recording chemical analyses of representative aircraft and automobile anti-friction bearing metals, and the chemical requirements of English and American specifications for tin-rich bearing alloys. He then proceeds to take up the various chemical elements upon the tin-base alloys, dealing briefly with antimony, bismuth, copper, iron, lead, nickel, tin, and zinc. He gives a mixture which has been utilized for locomotive axle boxes which contains approximately 80 per cent zinc, 15 per cent tin and 5 per cent copper. A bearing metal of French origin introduced with the object of reducing to a minimum the use of the more expensive metals, has a composition zinc 63.3 per cent, tin 21.3 per cent, lead 12.0 per cent and copper 3.3 per cent. There are also tables showing the physical and thermal properties of bearing metals; handling temperatures and Brinell hardness values of various alloys and the co-efficient of friction. This article makes a valuable reference for any user doing work with such alloys.—*The Automobile Engineer*. Eng., Aug., p. 225.

Methods of Machine Tool Design

By A. L. DeLeeuw
Consulting Editor, *American Machinist*

Design of machine castings to prevent warping—Machine members to resist torsion and bending — Pleasing appearance a factor in design — Machine bases and columns

EVERYONE is familiar with the idea that castings change their shape and continue to do so quite some time after they are made. The idea prevails that no good results can be obtained and no accuracy maintained unless the main castings of a machine are seasoned. There is a good deal of truth in this idea, but on the other hand it is very much overworked. Castings do change shape and for very accurate work it may be advisable to season them, that is, give them time to take their final permanent shape under the influence of varying conditions of temperature, etc. However,

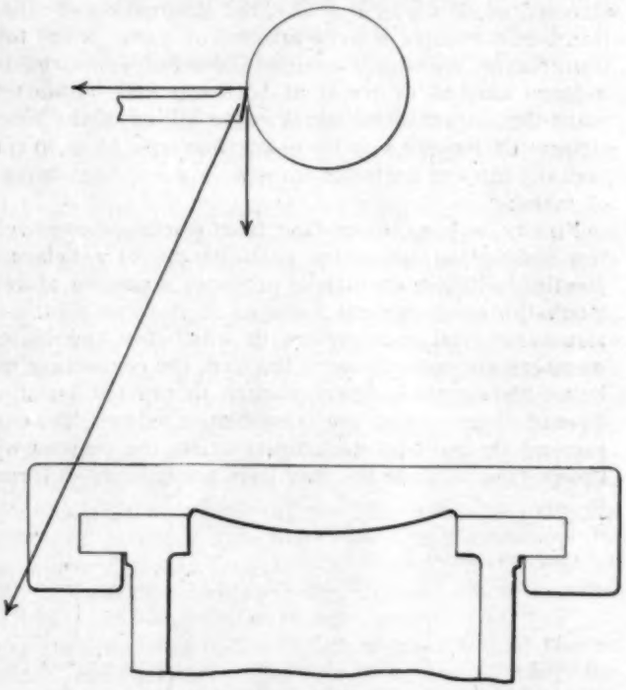


Fig. 233—Diagram showing direction of forces on a lathe bed

for most kinds of work the process of seasoning is not necessary, provided the castings have been made of the proper shape and section.

A lathe bed, such as shown in section in Fig. 231 at *A*, might require seasoning. This general form of cross-section is often employed but it is not to be recommended. It will be noticed that no Vees are shown in the figure and this was done to leave out all non-essentials. The figure does not give any idea of the proportions of a lathe bed, but merely shows the fact that there are two vertical webs, each carrying a heavy mass of metal at the top and a relatively small bead at the bottom. They are connected by a cross rib which also has more metal at the top than at the bottom. This construction would almost certainly require seasoning if we wished to be sure that the lathe would retain its accuracy. The bad conditions are made worse by the fact that the top members are planed, whereas the bottom members will probably be found to be rough.

The necessity of seasoning a bed of this design will show itself in the foundry. It will be found that such a bed, when molded straight, will generally come out bowed thus showing the unequal stresses in top and bottom members. The proper way to make such a casting is to balance it, that is, to allow a certain amount of metal at the bottom sufficient to counteract the large amount of metal at the top. A further precaution would be to plane the bottom as well as the top.

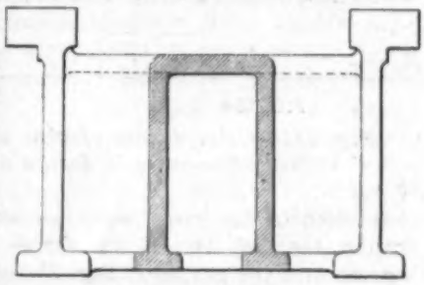


Fig. 232—Properly balanced lathe bed casting

As a rule it is not necessary to have as much metal at bottom as at top. This bed has a tendency to become concave on the top side. This tendency is somewhat reduced by the removal of the scale, so that if the bottom were not planed a certain mass of metal at that point would have a greater tendency to make the bed concave toward the bottom than the same amount at the top would have a tendency to make it concave in the opposite direction. As the top is planed it is therefore no longer necessary to have quite so much metal at the bottom. For this reason it might seem that it would be advisable not to plane the bottom, so as to permit a smaller amount of metal there to counteract the

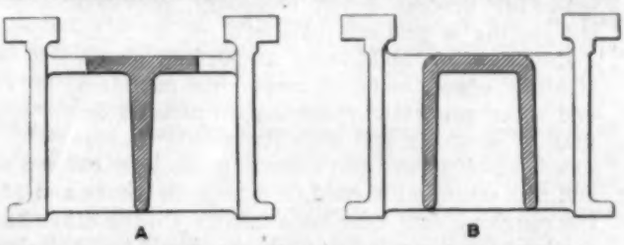


Fig. 231—Sections of lathe beds which probably require seasoning

For the author's forthcoming book. All rights reserved. This is the seventeenth article of the series. The sixteenth was concluded on page 509, Vol. 61, No. 13.

top more completely, but the scale at the bottom affects the bowing of the bed in a rather uncertain manner. It is, therefore, better to plane the bottom also. Nevertheless, as the slides are not planed at the bottom it is still permissible to have less metal there than at the top.

A modification of the cross rib as shown at *B*, Fig. 231, is often seen in lathe beds, planer beds, etc., and is an improvement on the construction first shown, so far as strength and rigidity are concerned. This construction of the cross web, however, does not help to make the bed retain its shape under the internal stresses in the casting. Fig. 232 shows a cross-section more properly balanced. It will be seen that flanges are added to both the longitudinal and cross webs on the bottom side.

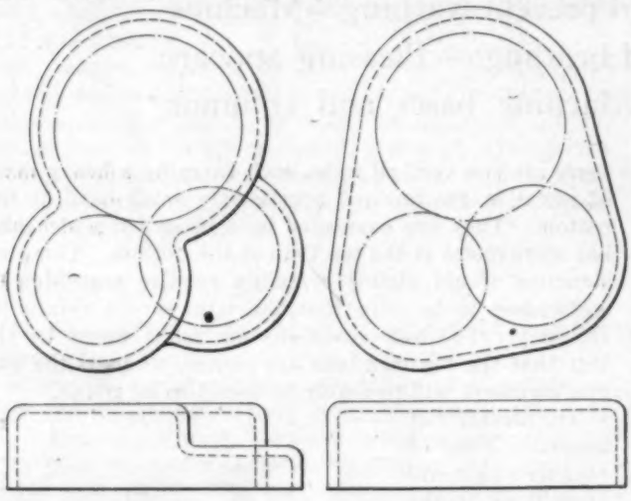


FIG. 234 FIG. 235

Fig. 234—Older design of gear shield. Fig. 235—Present practice in design of gear shield

The writer has found that when casting long lathe beds of the general shape *A*, Fig. 231, it was necessary for the molder to bow the mold very considerably in order to get a casting that was fairly straight. There were cases when as much as ¾ in. of metal was allowed for finish on the ways of a bed 33 ft. long but it could not be trued up without first being straightened. On the other hand, beds 40 ft. long of the general construction shown in Fig. 232 could be cast without bowing the mold and could be trued up with considerable less allowance for finish.

In late years a method has been developed for rapidly seasoning large castings by subjecting them to moderately high temperatures alternating with lower temperatures. However, this procedure requires a considerable installation and is quite costly. It is the writer's belief that for all ordinary work the seasoning process is not necessary, provided the casting is properly balanced.

Castings for such items as surface plates, straight edges, beds of measuring machines and other apparatus requiring an unusual degree of accuracy and stability should be seasoned, however well the balancing has been carried out, and this seasoning should be done both before and after the roughing cuts have been taken. On the other hand, castings for commercial machines should be so designed that seasoning is not necessary. Under those conditions there may be a small amount of working going on after the machine is installed, but this amount will be so small on the smaller machines as to be negligible, while long machines are always placed, or at least should be placed, on foundations. The amount of settling and shifting in the foundation itself is generally greater than any amount of variation which occurs in the casting due to lack of seasoning, and everyone is familiar with the fact that machines placed on foundations and used for accurate work must be re-aligned every so often. The amount of re-alignment required due to the working of the foundation is much greater than that required due to the working of the casting. Nothing, therefore, can be gained by seasoning such castings except when they are so badly designed that it is not possible to finish them to the proper shape and keep them long enough in that form to permit the building up of the complete machine.

One of the talking points in selling machine tools is weight. It has been pointed out that a large mass of metal in the frame work of a machine helps to obviate vibrations. To that extent weight is beneficial but, even considering this feature alone, it is not immaterial where that weight is placed. Taking a lathe bed again as example, a heavy mass of metal in the top of the bed will do much more to kill vibrations than the same amount of metal at the foot. If a lathe bed were constructed as shown in Fig. 231, the elimination of vibration would require a large amount of metal at the top; the greatest resistance against deflection would require a large amount of metal at both top and bottom; to make the bottom metal assist in the killing of the vibration would require a fairly heavy side web, so as to connect the top and bottom members by a sufficient amount of metal.

Finally, to keep the casting from working excessively, top and bottom members must be properly balanced. Meeting all these conditions produces a casting of very much the same general form as if it were a built-up structural steel construction in which top and bottom members are made to carry the load, the connecting web being merely made heavy enough to prevent buckling. Though there is a strong resemblance between the casting and the built-up steel construction, the reasons why the casting is made the way it is are entirely different.

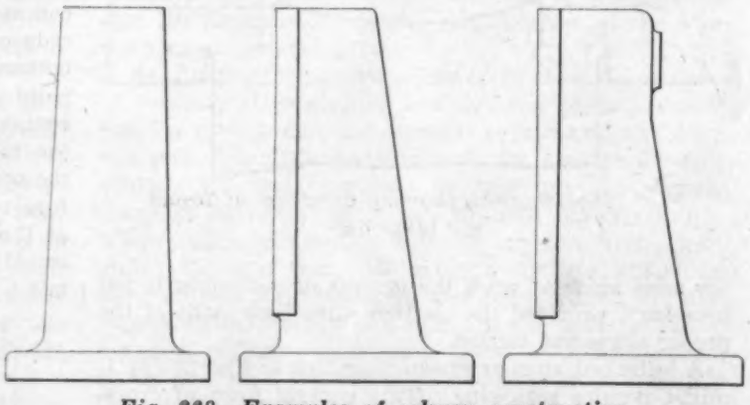


Fig. 238—Examples of column construction

In the steel construction we are dealing with strength and deflection, in the casting we are dealing with deflection, absence of vibration, and balancing of the casting to prevent working.

Lathe beds and cross rails of planers and boring mills should be designed to resist torsion and bending. The

bending does not take place at right angles to the plane of the top of the bed or cross rail, but at some angle which depends on many items, such as the diameter of the work, the depth of cut and feed, condition of the tool, etc. The direction of the forces at work is always at an angle to the top surface of the bed or cross rail as shown in Fig. 233. The amount of this angularity is variable, but the general conditions are always the same. As a result, when the cutting tool is carried on the front of the carriage of a lathe, the front web will have to resist bending to a much greater extent than the rear web. In planers and boring mills this condition is further aggravated by the fact that the tool always overhangs.

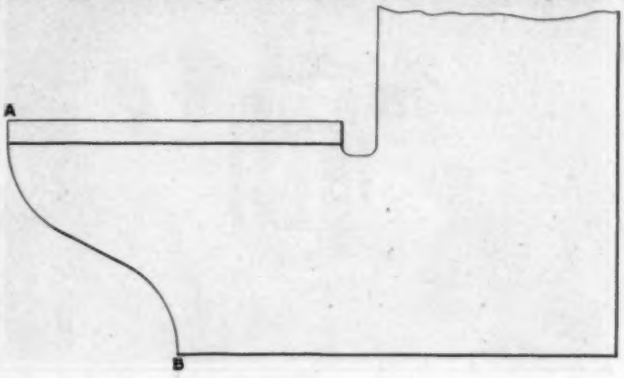


Fig. 236—Poor design for slotter bed

Torsional Resistance of Lathe Bed

As to resistance against torsion, the only way in which the torsional resistance of the back web comes in play is by its connections to the front web. If this connection is made of cross webs, as shown in Fig. 231, there will be large stretches of the bed in which the back web is of practically no assistance in resisting torsion. The ideal construction for resisting torsion would be to make the bed of tubular or box section, all four sides closed. That this is not done as a rule is caused by the necessity of finding room for some depth of carriage and to provide means for the disposal of chips. In the heaviest kinds of lathes, however, the box section construction is very closely followed. The fact that the lathe is large automatically provides sufficient room for depth of carriage and the chips are disposed of by removing them at frequent intervals from the top of the bed and by providing holes through which they can fall to a sub-cellar in the foundation.

A consideration in the design of machine-tool frames which has not been mentioned before is that the machine, when completed, should have a pleasing appearance. There was a time when designers would resort to architectural ornamentation, scroll work, ogives and bead-work. It is not so very long ago when the bell on a locomotive was hung from a cast-iron flower wreath, and though machine-tool designers never quite reached this artistic height, they made a vigorous attempt to run a close second. We have left this period of false artistic ideals behind us, but we are not always conscious of the fact that when a machine tool is so constructed that it meets its purpose and that the parts are properly proportioned for strength, rigidity, and general usefulness, the machine will automatically present a pleasing appearance. The machine-tool designer has plenty of problems to solve and to be freed of the necessity of considering the aesthetic requirements should give him a sense of relief. Nevertheless, there are a few things which he should do and a few others which he should not do in order to give the machine the best possible appearance.

One of the things to be kept in mind is that a machine should be kept as free as possible from all unnecessary protuberances, bosses, pads, beads, etc. The designer should keep in mind the fact that a round here or there may have various effects. Generally speaking, rounding will relieve the severity of the outline and make the machine or a part of it appear smaller. On the other hand, a succession of rounds may have the effect of making the machine appear complicated and large. Fig. 234 shows a gear shield as it was generally made not many years ago. This shield covers three gears, two of which are in one plane, whereas the third one is in a lower plane. It used to be the tendency to follow the outline of the gears to the fullest possible extent. This succession of curves and planes calls the attention of the observer to this particular part and has the effect of dwarfing the machine and increasing the size of the gear shield to an undue extent. Nowadays it is considered good practice to make the shield as shown in Fig. 235.

Another example of wrong and right methods in the design of machine parts is shown in Figs. 236 and 237. In Fig. 236 the bed of a slotter or perhaps a vertical milling machine is shown. The front is constructed with a reverse curve. This curve has the effect of calling attention to the fact that the surfaces which support the working part are larger than the surface which supports the entire mechanism. There is no reason whatsoever for making the construction this way, because it involves more pattern making as well as more molding and more complicated cores. Fig. 237 shows how the bed should have been made. The excuse has been offered that the construction of Fig. 236 was followed to give the operator a chance to come closer to the machine, but as he did not have that chance on the side, where he generally operated, it is hardly possible to see why he should have this extra clearance in front. Besides, the offset between the points *A* and *B* was often 24 in. or more and it is not likely that machinists of former years had feet of such a size that 24 in. of clearance was required.

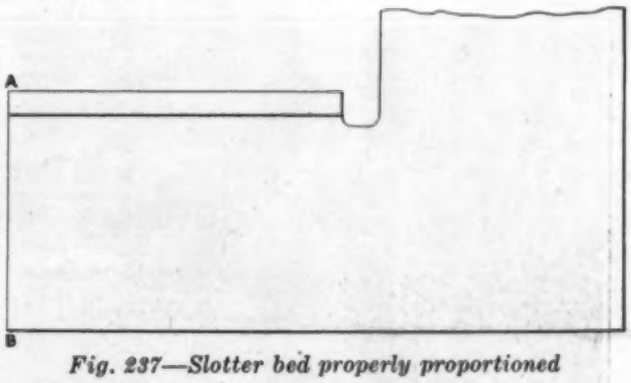


Fig. 237—Slotter bed properly proportioned

When the frame of a machine consists of a column, or any other part of which the main dimension is in a vertical direction, and such a part is made with parallel sides it will give the impression that the top is larger than the bottom and that the part is top-heavy. To avoid this appearance a slight taper should be given to the rising walls. It is highly probable that one of the sides

of such a column is used as bearing surface, in which case it must have parallel lines; but the fact that the other sides are made with a taper eliminates the effect of top-heaviness. When one side is straight the taper of the opposing side should be made about twice what it would have been if both sides had had a taper. Such uprights as housings of planers or boring mills need no consideration because they are made curved and consequently have even more taper than columns.

It is sometimes difficult to make the entire side of a column with an even taper. Somewhere near the top there may be a boss or pad which would project too far if the body were made with taper. In that case it is well to extend the taper only part of the way, leaving the upper part straight. Fig. 238 shows examples of column constructions.

Air-Cylinder Valve Holes Bored in Radial Drill

BY J. HAYDOCK

Valve holes in air cylinders can be bored accurately and at a high rate by the use of a modern radial drilling machine. Fig. 1 shows this operation being performed on a 22-in. cylinder for an Ingersoll-Rand air pump.

A special tool, Fig. 2, is used to machine all the surfaces in each hole at one setting. This is a combination boring tool, pilot and facing cutter and finishes the work

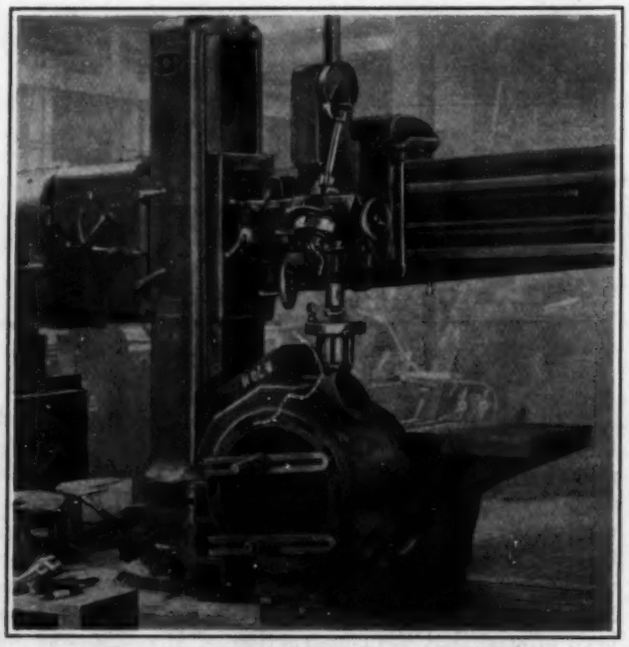


Fig. 1—Air cylinder set up for boring valve holes

in one cut from the rough. A feed of 0.031 in. and a speed of 21 r.p.m. is used until the large diameter counterbore comes in contact with the casting, when the feed is reduced to 0.008 in. per revolution. This gives an actual cutting time of about 6 min. 50 sec. per hole. By forcing the tool this time can be further reduced but the wear on the cutting edge then becomes too rapid.

The right line radial drill built by the Niles-Bement-Pond Co. was used in performing this job. This machine drives direct through the divided column from the motor to the spindle. It is possible to make these heavy cuts with a power consumption of nine horsepower.

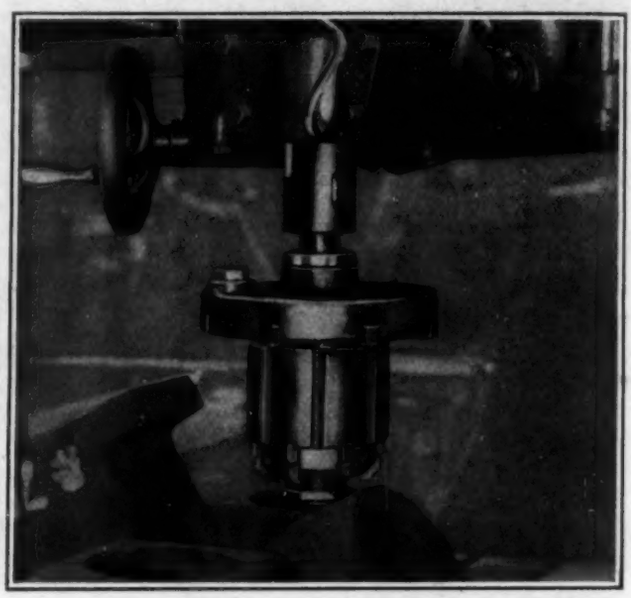


Fig. 2—Special tool for boring valve holes

The quick feed adjustment makes it possible to change the feed as the various cutters come into contact, without interrupting the work. The use of the electric column clamp enables the operator, from his position at the head of the machine, to lock the arm in position after each setting of the tool.

Use Thick Cutters for Cutting Off

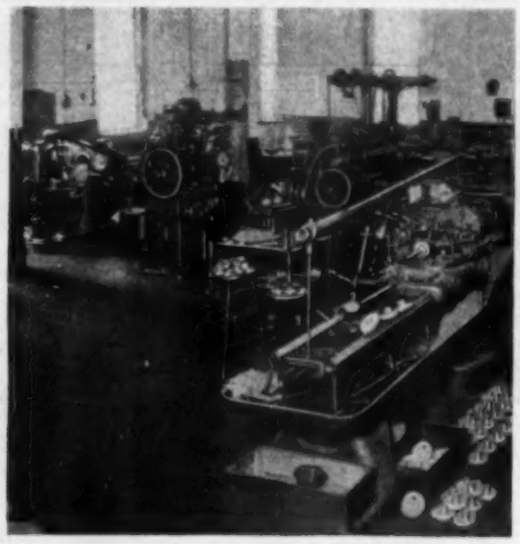
BY DONALD A. HAMPSON

One of the leading rules for guiding set-up men on screw machine work is "Do not use a too thin cutting-off tool." This rule may well be carried to the milling machine department where bar stock is cut to length.

Thin cutters work well on some soft metals but for continuous service on steel they are decidedly uneconomical. In theory the thin cutter should do as well as a thicker one, for it is the corners of the teeth that lose sharpness first, and then the cutter begins to pinch and make trouble. In practice, the thin cutter loses its edge with but a fraction of the cutting that a wider one will endure.

One shop that has done a great deal of cutting off on milling machines started with $\frac{1}{16}$-in. cutters. These gave trouble all the while, even though the depth of cut was but $\frac{3}{4}$ in., the feed light, and the speed slow. A change to $\frac{1}{8}$ in. thickness helped materially, and it also brought greater accuracy of lengths cut; which was highly important. Later, $\frac{3}{16}$-in. cutters were tried out and now $\frac{1}{4}$-in. cutters have been adopted as standards. Speeds and feeds have been increased with the increase in width and a degree of accuracy attained that was formerly possible only with much hand finishing.

Though seemingly slow, the milling machine may be found to be the speediest tool upon which to cut off stock that must be close to length or with ends straight and square. Plotting the time spent in squaring up ends, filing burrs off from rough cuts, and handling after the more rapid processes of cutting off, against the single slow operation of milling may show a saving that would not be believed off hand.

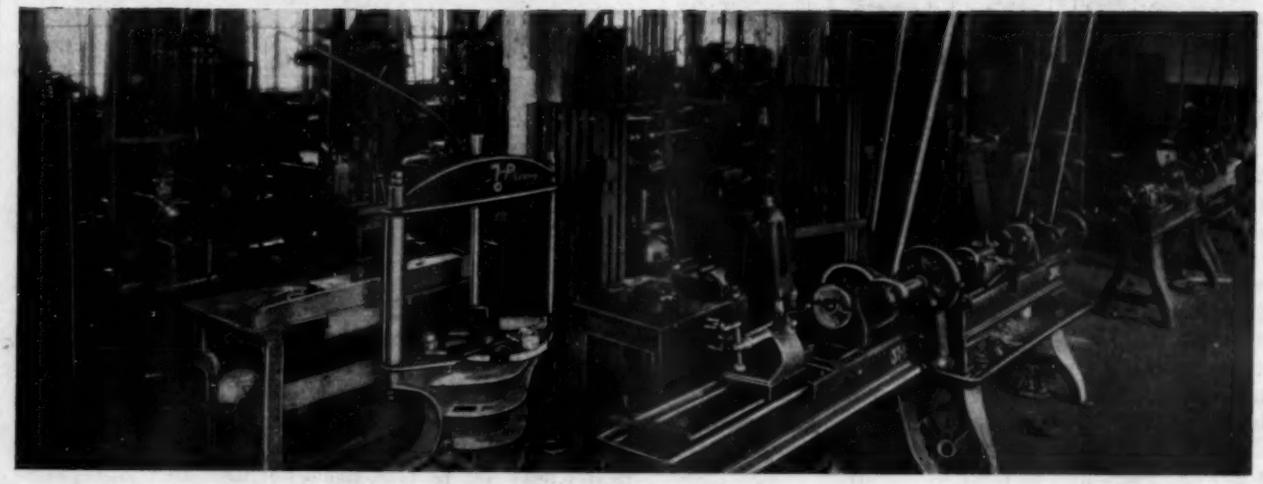


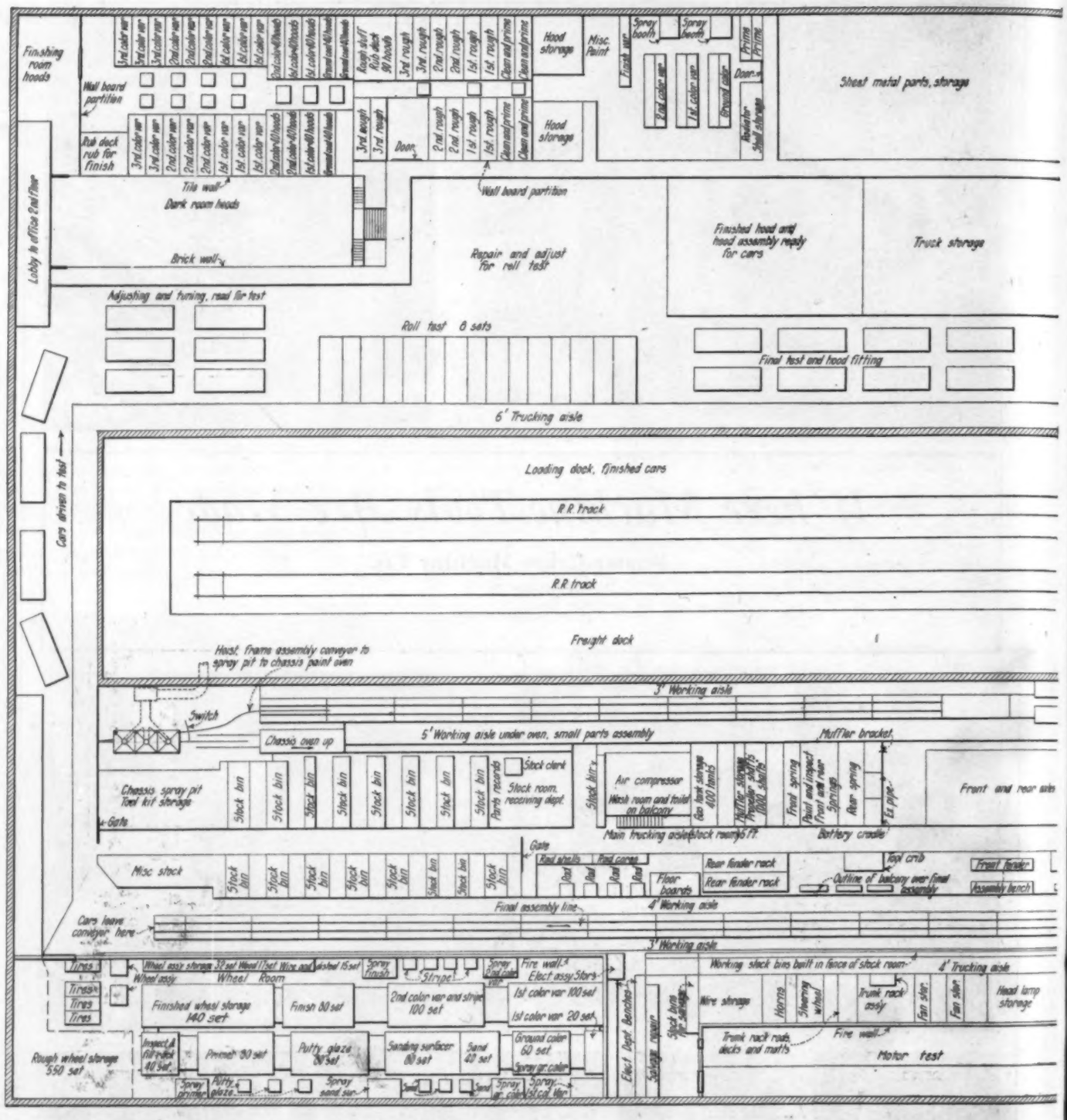
Where Machine Tools Are Made

Porter-Cable Machine Co.

Syracuse, N. Y.

Founded 1906





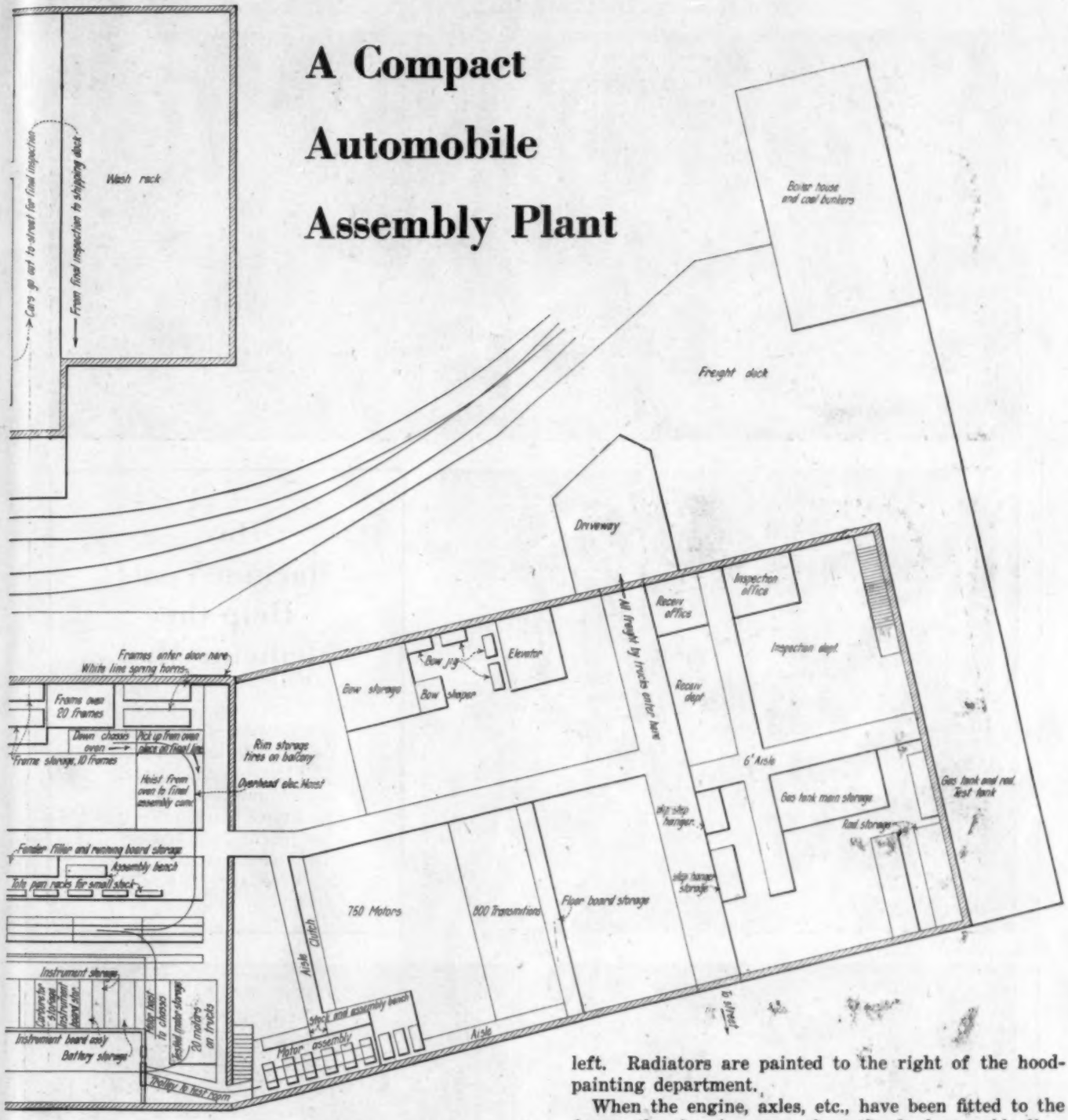
THE automobile assembly plant shown is that of the Jordan Motor Car Co. It is laid out in a very compact manner so as to eliminate lost motion and to reduce the handling of parts to a minimum.

All incoming material, which includes practically all the units which go to make up the car, enter at the right of the building and are inspected before being put into stock. The test tank for gas tanks and radiators is at the extreme right, adjoining the storage space for both. The storage of other parts can be seen to the left. Provision is made for storing 750 motors and 800 transmissions, clutches being next to the motors. Tires are stored on a balcony over the rim storage; another method of securing compactness in the plant.

Motors, clutches and transmissions are assembled where shown, and go to the test room by overhead trolley, returning to the storage for tested-motors where twenty are kept available on trucks. A motor hoist carries them to the chassis over the curved track shown.

The frames, which enter the shop where shown, go through the ovens (which hold twenty) and from there go by hoist to the assembly line near the tested motor storage. A little study of the location of the stored parts will show how they are fed into the assembly line as needed. Working stock-bins are built into the wall of the stockroom and not only save space but are in the most convenient place for the men engaged in assembly.

A Compact Automobile Assembly Plant



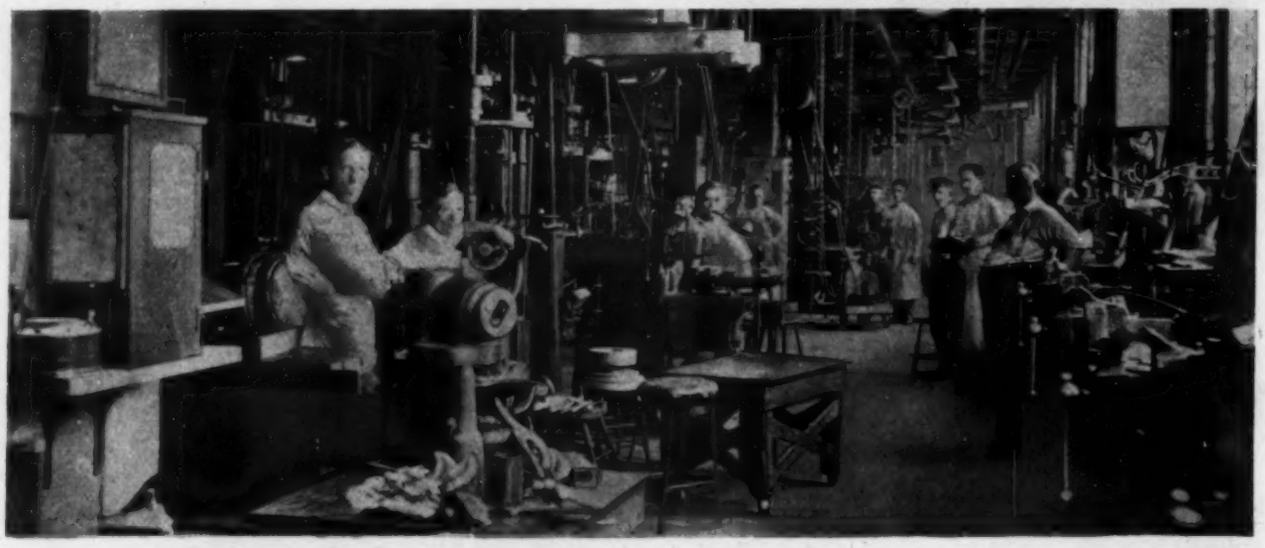
The ovens are on the second floor, the space beneath being occupied by a 5-ft. aisle and the small-parts assembly, utilizing space to the best advantage.

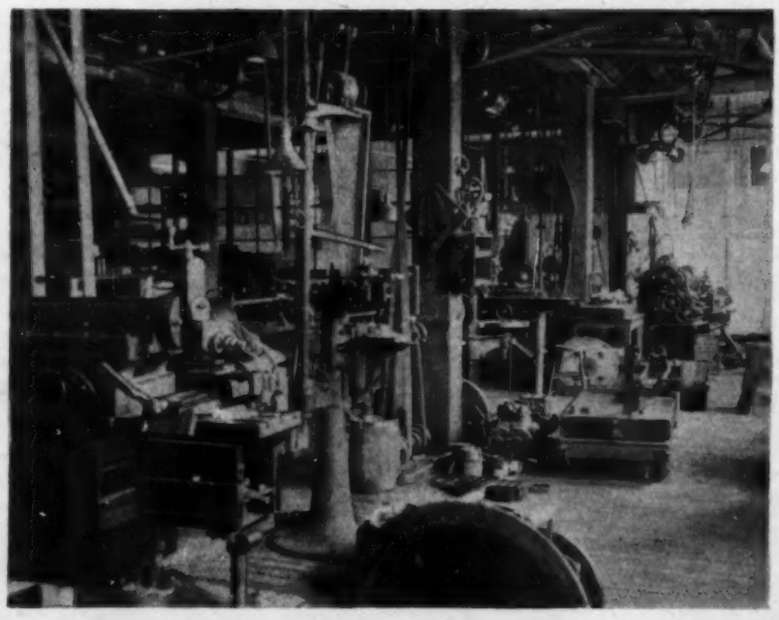
In the lower left-hand corner is the wheel room, enclosed by a fire wall. In it the wheels are primed, painted and varnished. The different blocks are arranged to handle 80 or 100 sets of wheels, according to the operation. The small block at the left is for inspection and can take care of 40 sets at once.

The upper left-hand section shows the hood-painting department which is subdivided according to operations. Forty hoods are handled in each section. Beginning with the hood storage at the right, the hoods are cleaned and primed, have three coats of color varnish and pass to the hood finishing room at the extreme left. Radiators are painted to the right of the hood-painting department.

When the engine, axles, etc., have been fitted to the frame, the chassis moves along the final assembly line, where wheels are put on. The car then goes to the extreme left of the building, following the end wall as shown, through the passage at the end of the railroad tracks, and around, three abreast, to the roll test which accommodates eight cars. From here the cars pass along beside the finished-hood storage where they receive the final test and have the hood fitted in place.

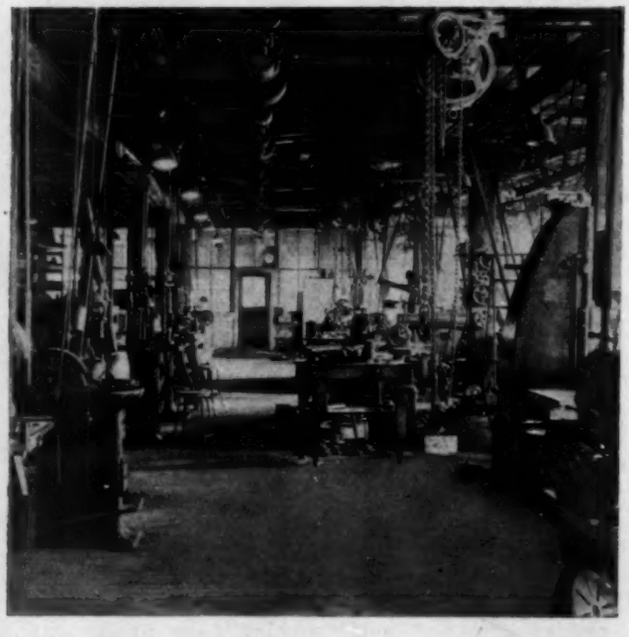
Only a bare outline has been given of the layout and the way in which the parts go through the plant to meet the assembly lines at proper points. But it is easy to follow the details more closely from the plans shown and to note the way in which space has been utilized and lost motion avoided. The plans are well worth a careful study by anyone at all interested in economy of space and the reduction of handling costs.





How Machine Tools Help the Medicine Man

These four photographs were taken in the plant of Parke, Davis & Co., Detroit, Mich., and are an indication of the variety of machine shop equipment required by the modern manufacturing chemist.



Equipment Required for Locomotive Maintenance

By Paul L. Battey
President, Battey & Kipp, Inc., Engineers, Chicago

Results of a survey for railroad rehabilitation —Locomotives in use but a small part of the time — Determining the size of repair shops

IN THESE days of high costs of labor and materials as represented in the large investment in equipment units and their maintenance, a comprehensive analysis of all of the factors involved in economic operation brings out some phases of the problem, rather outstanding, in the light of what has been considered common practice. It is essential that a proper balance between the ever-increasing size of locomotives, and the facilities for maintaining and operating this equipment, be constantly in effect, in order to minimize the time such expensive equipment is out of service.

It is this time element which the writer wishes to stress, as the use-factor of equipment is determined by it. The end of all economics is to maintain the highest possible use-factor of equipment, which means keeping it in actual service on the road, together with a reduction of man hours in maintenance, consistent with adequate service.

There are several factors involved in this result other than that of maintenance facilities, such as traffic and climatic conditions, as to which no two railroads are alike. Traffic charts have their peaks and depressions and any mechanical analysis as to maintenance facilities must be made having in mind traffic demands. Frequently advantage may be taken of seasonable fluctuations in traffic in the conduct of maintenance work, resulting in considerable saving in annual costs even though added investment be required.

It is the intention to describe briefly the scope of an analysis recently made for J. H. Young, receiver, of the Denver & Rio Grande Western R.R. System, in order that he could include in his budget for a general rehabilitation of the railroad as a whole, the terminal facilities and repair shops for the mechanical department, so as to maintain the motive power and car equipment in first class operating condition.

Capital Mileage of Rolling Stock

The first problem was ascertaining the capital mileage in locomotives and cars as the equipment was found on the system. By capital mileage is meant the total available miles in each locomotive and car until its next general repair. To maintain rolling stock in par condition the same amount of mileage per annum should be restored by the shop facilities as is used in operation.

The survey included careful study of the disposition of the power on the several divisions and the particular local requirements of each division which, in this case, were unusually varied because of topographical conditions and the fact that they have required the maintenance of both standard and narrow-gage equipment. Consideration was given to the possibilities of longer divisions with the mountain type of engines which were being purchased and the probability of the ultimate electrification of the mountain divisions.

Actual Service Time of Motive-Power Units

One important phase of the analysis was the determination of the time each motive-power unit was actually on the road in service, and the results indicated that the actual use-factor of a motive-power unit to the operating department is between 20 and 30 per cent. A careful analysis of the distribution of locomotive hours in this case showed that approximately 65 per cent of engines were serviceable and the balance unserviceable. Of the former, 15 per cent were in engine houses in the hands of mechanical department, 26 per cent in engine houses awaiting trains, 3 per cent at terminals and 20 per cent actually on the road or in yard switching-service. Of the unserviceable 5 per cent were waiting repairs, 24 per cent undergoing repairs in shops and engine houses and 6 per cent set aside as obsolete.

Comprehensive analysis required full information as to character of assigned engines, engine failures, time required to turn, to wash boilers, and the numerous other factors involved, to the proper conclusion as to size of roundhouses, boiler washing plants, water treatment, capacity, length of turntables and local repair facilities, all with the purpose of establishing a balanced condition of operating and repair facilities throughout the system.

The outcome of the analysis was the complete rehabilitation of the two principal repair shops located at the extreme termini of the road—Denver and Salt Lake City, and extensive improvements in the terminal at Grand Junction, probably the most central point on the entire system. In fact, the analysis involved a careful study of the advisability of building an entirely new central repair plant at Grand Junction in lieu of the two existing plants at the ends of the road.

However, the additions at Grand Junction were carefully located as the initial move towards a general repair plant at this point at such time as the Denver and Salt Lake City shop-capacity would be exceeded.

Abstract of a paper presented at a meeting of the Western Society of Engineers, Chicago, September 22, 1924.

The terminal facilities were improved by the installation of a new 110-ft. 450-ton, 3-bearing turntable and lengthening the roundhouse to properly take care of the new and larger engines contemplated for operation over the extended division from Denver.

New drop pits were installed, together with modern heating and electric lighting installations. This, in conjunction with the new locomotive repair shop with a capacity and equipment for four heavy engines, including modern tools. Whiting locomotive hoist and crane service, provides for adequate and efficient handling of equipment on the division.

Terminal improvements at two other points were also developed, one at Salida, Col., junction point of the narrow-gage system with the standard-gage main line. Here roundhouse and terminal repair facilities were extended, this installation being approximately the same in repair capacity as at Grand Junction, similar equipment was provided.

At Alamosa, Col., which is practically the center of gravity of the southern Colorado section of the road and narrow-gage lines, a very fair repair shop was in service, relatively better in character than at other points on the line. The principal improvements required here to bring the plant up to balanced condition were extension to the roundhouse, the installation of boiler-washing and steam-heating systems, a longer turntable, a small extension to the repair shops, some new and modern tools and change to electrical drive throughout, with improvements to the power house.

The measure of capacity to determine the size of a locomotive shop should be the product of a tractive-power unit and the locomotive miles consumed on the road, for the reason that the weighted average of engine size must be considered with mileage to form a working factor. As before mentioned, it is necessary to put into the locomotives by renewals and repairs, the same number of miles that are taken out of them on the road. If for example, the total annual locomotive miles were 12,000,000 and the average tractive power of all locomotives making this mileage is, say 40,000 lb. or 40 units of 1,000 lb. each, the total T.P.U. miles consumed on the road would be 480,000,000. To maintain the power in par condition shops must in a year, turn out the same number of T.P.U. miles. The measure of their gain or loss over any period of time may readily be ascertained by balancing production and consumption. A formula for arriving at erecting-shop capacity may be expressed in the following terms:

$$C = \frac{N \times D \times L}{\frac{MR}{MA} \times Y}$$

where

C = Total lineal engine erecting space.
N = Number of engines tributary to shop.
D = Calendar days in shop.
L = Average length of space allowed per locomotive.
MR = Average T.P.U. mileage between repairs.
MA = Average T.P.U. mileage per locomotive per annum.
Y = Days per year (365).

This applies to a longitudinal shop but the formula may be used for a transverse shop by eliminating L and considering C as number of pits.

The real output capacity of a modern railroad repair-shop is dependent upon proper machine-tool equipment, crane service and the organization and method of handling equipment through the shops, more than the actual floor space occupied by standing equipment undergoing repairs.

Railroad mechanical-department officials have been for many years divided into two parties, one favoring longitudinal and the other transverse shops, but now there comes a third party with new and radical ideas as to shopping engines who styles its plan of shop the progressive type. It must be understood however, that the third party lays claim to constructive principles. While this demands better organization, with such, it is capable of greater adaptability to varying conditions of operation and under all conditions shows an extremely attractive increase in both the efficiency and the output.

On the D. & R. G. W. the locomotive shop was so arranged that the service tracks run parallel with its length, but the routing of the locomotives is such within the shop that a progressive or semi-progressive handling results, which makes possible low unit repair-costs in the various departments.

Arrangement of the Shop

The shop is departmentized so far as it is feasible, machine tool groups for the various operations being placed immediately adjacent to the section of the erecting shop where such parts enter the assembly. Thus the wheel department is at the extreme end of the shop adjacent to the unwheeling and wheeling pits and immediately next is located the driving-box department and so on. A balcony extending under the machine-shop crane so as to be served by same is provided for the brass department, head light, electrical and other similar work. The boiler shop is located in the opposite end of the building from the wheel department but so arranged as to be served by the erecting and machine-shop cranes, thus minimizing the movement of boiler work. The result of the departmental relationship is such as to reduce the lost time in the handling of parts to and from engines undergoing repairs to a minimum. The motive-power materials coming mostly from the east, it was evident that a manufacturing department located in the Denver shop at the eastern terminus of the system would be an economical provision, parts produced here to be distributed over the system through the stores department and this has proved a successful innovation. Because of the necessity of maintaining operation of the existing shops at both Denver and Salt Lake City, through the rehabilitation period, it was necessary to predetermine a schedule of operations, placing the various improvements in their proper sequence to secure a minimum of interference with the regular operation of the shop. This was carried out as planned in an entirely successful manner, the finally rebuilt plants being completed including the making of plans for same, within a year.

Rehabilitation of Power Plant and distributing systems, shop heating and ventilation and other service systems were provided in manner to correspond with shop requirements. Adequate electric overhead cranes, local hoists, and modern machine tools in ample capacity and variety were provided, including some of the heavy-production tools long used by manufacturers but not so generally by railroads—all these reduced time of machining operations, with resulting economy.

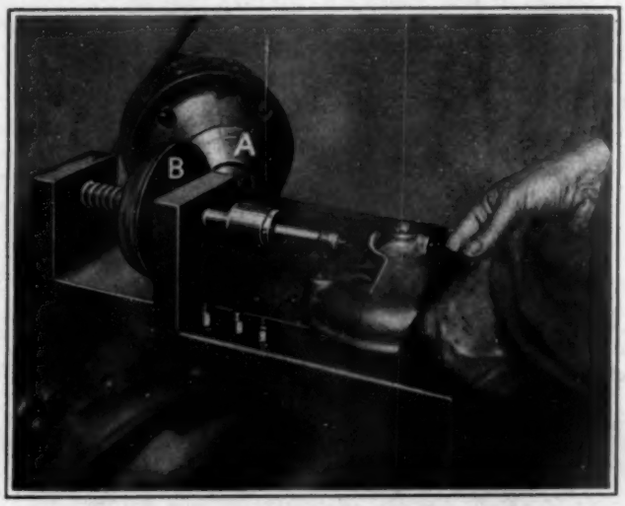
Ideas from Practical Men

Devoted to the exchange of information on useful methods. Its scope includes all divisions of the machine building industry, from drafting room to shipping platform. The articles are made up from letters submitted from all over the world. Descriptions of methods or devices that have proved their value are carefully considered, and those published are paid for

A Power Screw-Setting Device

By Henry Densmore

In the end frames of small electric motors used for domestic and other purposes there is usually some sort of oiling device intended to keep the rotor bearings supplied with lubrication with the least possible attention. The devices ordinarily take the form of cups, packed with wicking or other absorbent material that



A device for setting oil-wick tubes

will hold oil indefinitely and convey it by capillary action to the surfaces that need to be lubricated.

The Westinghouse household motors, in addition to oil-cups, have an oil-wick tube made from hexagon brass rod, chambered out to form a guide for the wick and threaded upon one end so that it may be screwed into the motor bracket. The job of setting innumerable tubes in place by hand was a decidedly tedious one until the little machine here shown was evolved.

The driving power is supplied by a Westinghouse household motor upon the rotor shaft of which the cone-shaped wheel *A* is located. A similar, but opposed cone wheel, *B*, is keyed to the shaft of the device, the shaft being supported by bearings in which it is free to revolve or to move endwise. A coil spring surrounds the shaft and bears against the cone-wheel *B* at one end and against the stationary frame of the device at the other and thus tends to keep the two wheels out of contact.

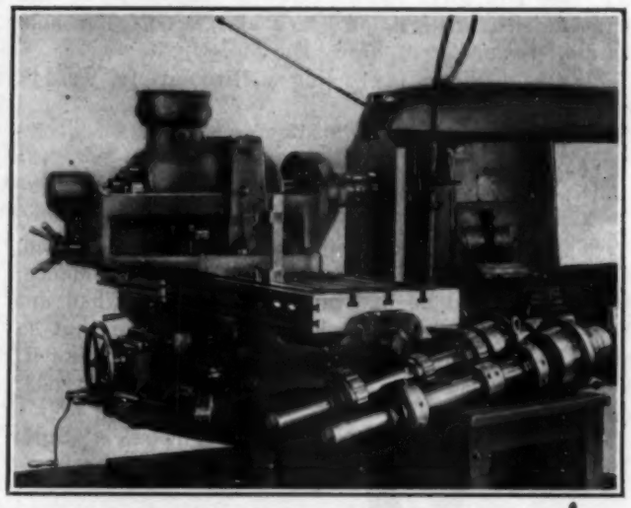
The spindle of the device terminates in a chuck in which may be held a drill, screwdriver or other tool—in this case it holds a socket wrench that fits over the hexagon end of the oil-wick tube to be set in the motor frame.

The operator sets a tube into the counterbored portion of the tapped hole in the frame, enters the hexagon end in the socket wrench, which is now stationary, and pushes the frame forward with sufficient force to compress the spring. This brings the wheel *B* into contact with the continuously revolving wheel *A*, thus setting the shaft in motion and screwing the tube into the hole. When the pressure upon the bracket is released, the chuck stops. The drive is entirely by friction between the two wheels and the harder the operator pushes the more firmly will the tube be set, but not enough power can be applied to twist off the tube.

Boring in the Milling Machine

By A. D. Frost

We had a number of compressor bodies to bore and our equipment did not include a boring mill. Since the quantity of pieces was not great enough to warrant the purchase of a boring mill, we decided to do the work on our No. 5 plain, high-power, Cincinnati milling



Fixture and tools for boring and reaming compressor bodies

machine, with fixture and tools designed and built by the manufacturer of the machine.

The illustration shows the job mounted in a special fixture on the machine. Two boring bars were used, one for roughing and the other for finishing. A third bar was equipped with reamers for sizing and producing a smooth finish. On the table at the right are one of the boring bars and the reamer bar. The bars are all interchangeable on the spindle nose and the ends are supported in an outboard bearing in the fixture.

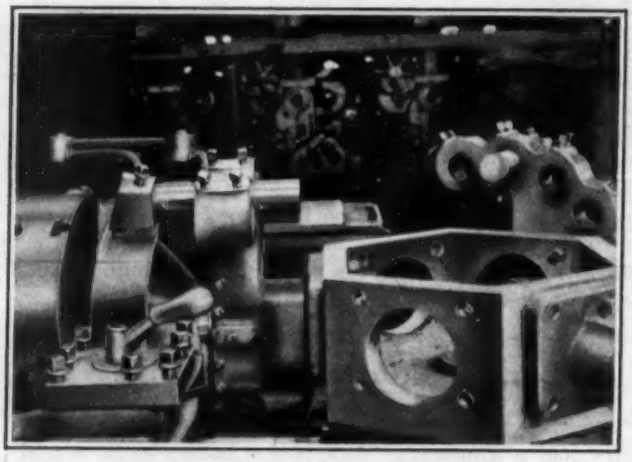
The holes were 3½ and 5 in. respectively and about ¼ in. of stock was removed. The speed was 16 r.p.m. and the feed ¼ in. per min. The time per piece was 48½ min. floor to floor.

Machining a Piston-Valve Follower

By Chester H. Franklin

The illustration shows the tooling of a No. 3-A Warner & Swasey universal for machining a cast-iron piston-valve follower for locomotive use. The turned diameter is 12½ in. and the length of the turned surface is 3½ inches.

The job was a comparatively simple one of six operations, including both the chucking and removal of the work. The first machining was to rough turn, bore, face and form radius. The next position of the turret finish turned, finish bored and faced. The hole was next reamed, completing the piece.



Tooling set-up for piston follower

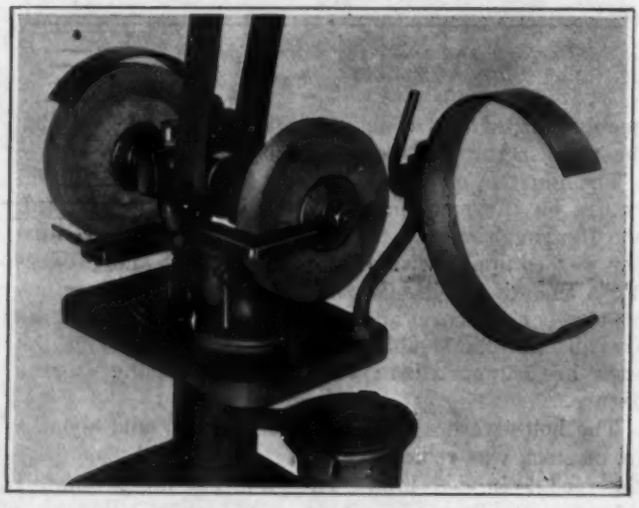
The floor to floor time, using stellite cutters, was 4½ min. each.

A Guard for the Tool-Grinding Wheel

By Jack Williams

The writer found the wheelguard, here illustrated, in the shop of the Graham Mfg. Co. in Providence. Mr. Graham said he had invented it himself, had applied it to all exposed wheels in his shop, and that so far as he knew no one had ever made a guard like it. It is certainly substantial, safe and, last but not least, convenient.

The machine upon which it is here shown is a standard two-wheel toolgrinder, made by the Diamond Machine Co. and is of a type to be found in almost any machine shop. The standard upon which the guard is supported is a piece of ¾-in. round, cold-rolled steel, offset as shown in accordance with the diameter of the wheel to be guarded, and provided with a long thread at one end upon which two hexagon nuts are run. A suitable hole is drilled through one corner of the table and the standard attached by tightening the nuts together, one above and the other below the table.



A substantial guard for a grinding wheel

A plain collar is driven upon the other end of the standard and left at the right height to support the guard in a position central with the wheel. The band of the guard is a piece of ¼x2-in. cold-rolled steel of rectangular section, and to it is screwed or riveted the bracket.

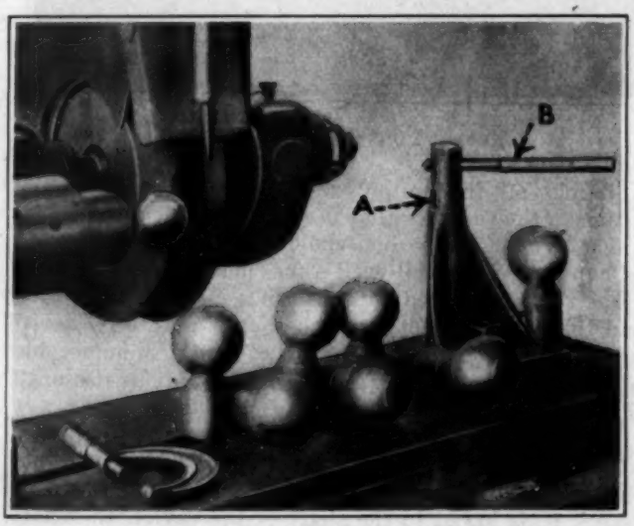
A piece of ½-in. round, cold-rolled steel is threaded at one end to fit a tapped hole in the bracket and is then bent to nearly a right angle to form a convenient handle. By means of this screw-handle the guard may be clamped in position to cover the wheel as shown at the left, swung to one side as shown at the right view, or lifted off and thrown on the bench.

When in use it answers every requirement. Like all other guards the writer has ever seen, it requires occasional attention from the boss to see that it remains on duty instead of on the bench.

Grinding Steering-Arm Balls

By Henry C. Francis

Balls for the steering arms of the electric trucks made by the Commercial Truck Co., Philadelphia, are finished by grinding on the machine shown in the accompanying illustration. The balls are formed on a turret lathe and after being heat-treated, come to the grinding machine.



Wheel-truing device for grinding balls

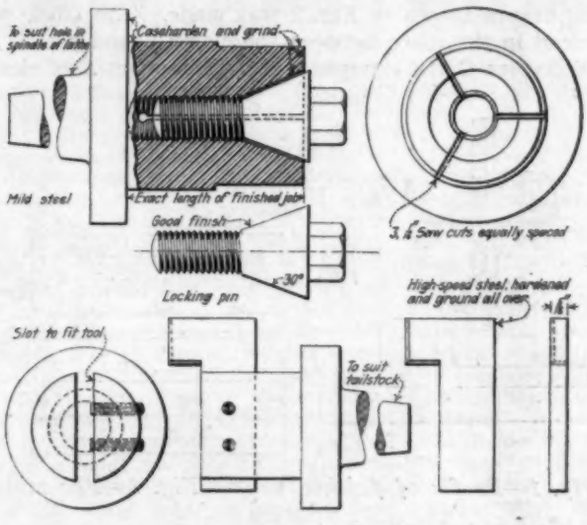
The tapered shank is held in a collet and the ball ground by a wheel shaped to the proper radius by the diamond held in the fixture at *A*. The diamond is held in the threaded end of the rod *B* so that it can easily be adjusted to swing the desired radius. This is important since the main requirement for grinding satisfactory balls with a formed wheel is to keep the face of the wheel correct in shape.

Saving One Setting in Machining—Discussion

BY A. SILVESTER

In an article under the above heading, published on page 817, Vol. 60, of the *American Machinist*, Albert A. Dowd claims that by the use of an ingenious and somewhat complicated tool-bar, the construction of which he shows, he can secure greater accuracy and at the same time reduce the cost of production upon the piece he has chosen for demonstration, by making it in one operation instead of two.

In my opinion the job shown is a two-operation job, and should be handled as such for the following reasons: 1—It can be done more quickly in two operations than in one. 2—The operator can see to better advantage what his tools are doing, therefore greater accuracy is assured. 3—The tool described by Mr. Dowd is altogether too costly, both to produce and to maintain. It is quite likely to get out of order frequently, especially if handled by the average workman, who regards an occasional "touch" with a hammer or spanner as the



Tools for finishing end of hub

proper way to adjust minor defects. Then, too, the cast-iron dust, mixing with the oil that must necessarily be used to lubricate the mechanism, could not be kept out of the working parts of the tool and would soon destroy its accuracy.

In actual practice, the diameters of the step portion of the work would begin to vary in a short time, as also would the length of the step, thus making necessary some means of correction after the job was removed from the chuck. It is obvious that these dimensions could not be checked while the job remained in its original setting, and thus a second operation would become necessary anyway.

On the other hand, when considered as a two-operation job, the fact that the face of the flange is on the same line with the end of the hub gives the workman an excellent point of departure for gaging. By placing a straightedge across the flange, he can see exactly how much stock is to be removed and know whether or not he is reaching or exceeding the limit before it is too late.

No diameter or length of hub is given by Mr. Dowd, but assuming the dimensions to be 4 in. and ½ in. respectively, it is easily possible to accomplish this job in a second operation with ordinary tools in a floor-to-floor time of two minutes for each piece.

My method of holding the job for the first operation would be the same as Mr. Dowd's, provided I knew that the casting was clean and true, and would lend itself to chucking by gripping inside the rim. To hold it for the second operation I would put a set of false jaws on the chuck and bore them to grip the work by the largest diameter, locating against the already finished flange. The end of the hub could then be faced off flush with the flange and the step turned to diameter and depth with ordinary tools, using stops on all movements.

Another method of holding the piece in a turret lathe would be by means of a draw-back expanding arbor and bushings to suit. I have had occasion to do many similar jobs in this way, and with reasonable care the whole piece will be a good job, capable of passing the most rigid inspection.

The accompanying sketch shows tools that I have often used on high-class work, the operations being similar to those required upon the piece under discussion. They are designed to be used in a standard engine lathe and the construction is so plainly apparent from the drawing that no written description should be needed. If the expanding chuck be ground in the lathe in which it is to be used, the resulting work will be true and concentric. There is nothing about the tools to get out of order and in the hands of competent workmen they should last for years.

A Method of Handling Tire and Wheel Work

BY H. K. GRIGGS

In all that has been written about locomotive tires I have not seen anything about removing old tires. My method is to cut through one side with an acetylene torch. With cast-iron wheel centers there is no danger of damaging the centers. In steel centers I cut over the filling piece. Generally the tires break when cut nearly through. By hanging the wheels with the axles in a vertical position two men can easily knock the old tires off.

Before setting new tires, I put the wheels in a lathe and face the outer edges of the rims to equal distances from hub plates. I get the new tires rough bored about ¼-in. smaller than the wheel centers. I first bore the tires on a vertical boring mill with the flange sides up, boring down to a square shoulder. The shoulder is located so that it will bring the inside gage of tires exactly 53¼ in. when set.

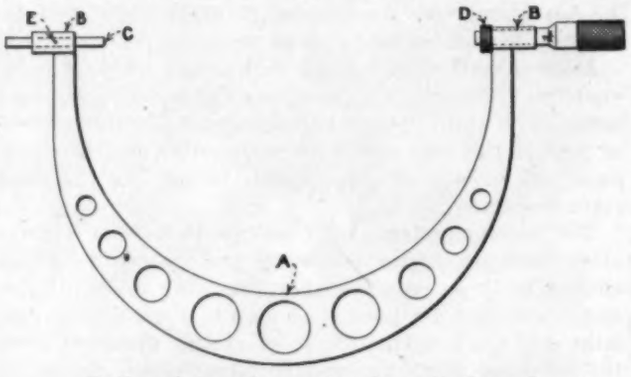
In shrinking tires in place, I hold the axles in a vertical position and when tires are hot, lift them by an electric crane with three legged tongs and lower them to position. By this system tires can be set correctly with unskilled labor. If tires set in this way become loose, they cannot possibly work inwards and the flanges would have a tendency to hold them the other way.

On tire work as well as on other large work, I have a special outside micrometer to measure the wheels. From the micrometer I make wire gages for boring. This method does away with the guess work, so common in some railroad shops.

The illustration shows the micrometer frame *A*, made of ¼-in. boiler plate, which is drilled with as many

holes as possible to lighten it. It is cut to shape with a torch and rough ground. Parts *B* are ⅜ in. round cold-rolled steel, electrically welded to the frame. The anvil *C* is a piece of ⅛-in. round cold-rolled steel secured in a reamed hole by a taper pin at *E*. The bar *C* can be of any length and have as many holes (one inch apart) as desired, to give different diameters. The other side is reamed ⅜ in. and is provided with a No. 294 Brown & Sharpe micrometer head.

I removed the micrometer thimble and, holding the



Boiler-plate micrometer for wheel work

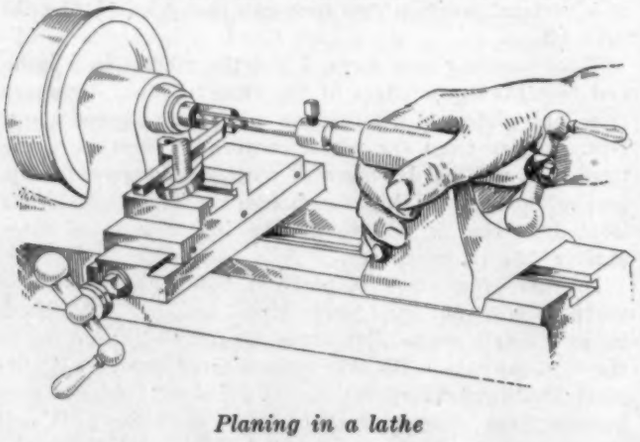
barrel in a drawin-chuck, cut a ⅜-in. 24 thread on the end and made a knurled nut *D*. The frame *A* is wound with electric tape and shellaced. I have different sizes of frames and by using the same micrometer-head I can have micrometers up to 60 in. and will make larger if needed.

A Planing Job in a Lathe

BY R. B. WARE

The drawing illustrates a method adopted by the writer to plane flats on some ¼-in. round steel rods. Not having access to a planer, shaper or milling machine, I rigged up a small bench lathe, fitted with a plain sliderest, to do the work.

The only special piece I had to make was the bar of ½-in. round stock that may be seen in the spindle of



Planing in a lathe

the lathe, and all the work necessary on this was to drill a hole lengthwise through it and cut away half the diameter for a short space at the exposed end. The hole through the center is just large enough to allow the ¼-in. rod to slide freely.

The rod to be planed was gripped by a collet in the tailspindle of the lathe and the tailstock was then moved back and forth along the bed by hand. The cutting tool was an ordinary square-nosed tool, laid upon its side with the cutting edge facing the headstock of the lathe.

After each pass of the rod, the tool was withdrawn slightly by means of the cross-slide and the rod returned to its first position. As the rod began to draw out of the guiding piece, the tool was fed in to take a cut of about 0.001 in. depth, in which movement the micrometer dial of the cross screw was of great assistance. This dial also provided a means of gaging the final depth of cut on each piece so that all were held to a uniform dimension.

A Duplex Milling-Fixture

BY C. T. KETZ

It was necessary to produce a large quantity of pieces as shown in Fig. 1, with surfaces *A* and *B* parallel.

Since both surfaces must be milled to a specified form, reclamping and reversal of stock are required by the ordinary method, making assurance of parallelism of the upper and lower surfaces almost impossible.

To obtain an acceptable product in a reasonable time, the fixture shown in Fig. 2 was made. The stock was placed in the space between the clamp *C* and heel *D* of the fixture *G* and clamped tight. The offset *E* of clamp

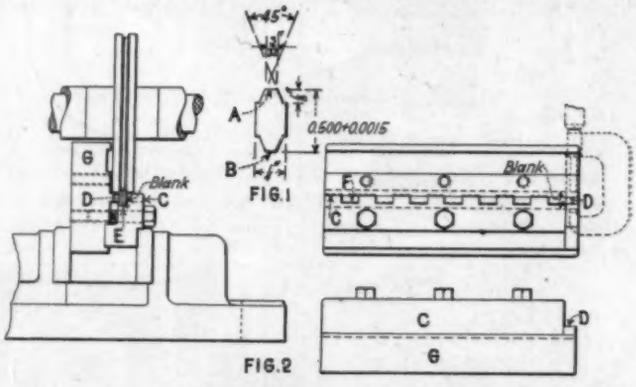


Fig. 1—Profile of finished work. Fig. 2—The milling fixture

C acts as a guide for the blank and thus keeps it parallel with the heel *D*. The whole fixture was placed in the milling machine vise and the upper side of the blank milled.

It will be noticed that the clamp *C* is made in comb form, the use of which will presently appear. When the upper surface of the work was finished, the fixture was removed from the vise. Before the clamp *C* was loosened, another clamp *F*, with teeth fitting into the spaces of clamp *C*, was placed on the opposite side (vertically) of the fixture and tightened, thus clamping the semi-finished blank without disturbing its original position. Clamp *C* was then removed, and the fixture placed in the vise again, this time, of course, with clamp *F* down.

For measuring of blank before the final cut was taken, the clamps *C* and *F* were made a little shorter than the body *G* of the fixture. At first a rough cut was taken and the blank measured with a micrometer as shown in the dotted lines. Then the table of the milling machine was raised as high as necessary, to suit the specified dimension, using the dial indicator of the vertical-table adjustment. The final cut was then taken, finishing the blank to the specified dimension within the limits of tolerance.

Technical Abstracts

Measuring the Quality of Product

G. S. Radford, consulting engineer, discusses Prof. Roe's suggestion that the quality of output can be measured by the rating ratio:

$$\frac{\text{Goods produced that pass all inspections}}{\text{Total goods produced}}$$

He indicates that inspection should include both producers' and customers' inspection. Mr. Radford criticises this as a means of gaging the quality of management and points out that the standards in use in the factory are probably set by the management whom we are attempting to measure and that the product is graded by the inspection almost certainly dominated by the management. If the standards are low or if the inspection is slack an efficient management will be credited with a fictitiously high rating. One point which does not seem to be discussed very fully is the question of spoiled work in process which would not seem to be taken into account in the above factors. This was slightly mentioned by one or two of those who took part in the discussion. The late Frank B. Gilbreth, for example, said he would lay greater emphasis on the "why" in the changes in the ratio rather than on the methods that made the ratio. Hugo Diemer said that by developing the re-working and salvaging departments, better results might be obtained at less cost than if an attempt was made to have all the equipment and processing perfect.—*Mechanical Engineering*, Sept., p. 546.

Applying the Gantt Chart in France

Serge Héranger, chief engineer of the Hotchkiss Co., France, automobile and machine gun manufacturer, describes how the Gantt chart has been applied to the methods of his plant.

The name of Gantt is one of the most honored in France and he has a record distinct from Frederick Taylor as contributing something entirely his own. The method of scientific control as illustrated by the special method of charting has been found of great value in the Hotchkiss work and the charts that they use are illustrated in detail. One deals with the transmission, another deals with the work of the automatic lathes in the automobile shop and the third deals with their machine gun work. Gantt charts are used in automobile work for the progress chart as applied to the stores department. The layout chart is applied to machine tool production, and in addition to the machine gun work there is a progress chart as applied to the rifle assembling department.—*Management & Administration*, Sept., p. 305.

Industrial Plant Location

P. F. Walker, Dean of the School of Engineering, University of Kansas, contributes a very thoughtful discussion to the question of what is the most economical place, all factors considered, to locate the plant.

Today, this is a problem of real significance and it is not only a question of the new enterprise. As is shown in another abstract, the Ford Motor Co. is giving considerable thought to this question of economic location of some of its units. The necessity for the lowest possible ultimate cost of manufacturing articles is leading plant designers to scan closely every factor. The problem is complicated by reason of the piecemeal growth which the country experienced during its developing years. This condition of concentrating on Eastern centers as producers, as well as the large area on the interior were being settled and developed as agricultural producing regions, has brought about a transportation system designed for long haul traffic. Manufacturers are finding many advantages by seeking locations in smaller towns more widely scattered, but they encounter disadvantages as well, rising from another form of transportation difficulty. This is the matter of freight rates, based on plans which fostered the original industrial centers. The result is inefficiency and increased costs.

Dean Walker states that this country has no industrial system in respect to distribution and the original plan has broken down completely. Transportation is the key to all industrial progress.

Curiously the author barely touches on the great advantages that the motor truck is bringing to the aid of transport. He proceeds to the factors which influence location and places these in their order: market, materials, transportation, labor, civic enterprise, power-lighting, water, and distribution cost. The individual industrial manager must count the cost of all factors entering into location as a surcharge on transportation. In many cases he will find that in spite of his desires for a location in the purer atmosphere of the small town he must take the course indicated by facts that show economy in the acceptance of the city location. This is the first of two articles.—*Management & Administration*, September, p. 259.

The Vickers Hardness Testing Machine

A description is given of a new machine that performs the same function as the Brinell testing machine does but in a much more refined manner. A diamond is used as the indenting tool and hardness figures are obtained identical with those performed on a trustworthy Brinell machine. Following the description of the chines and its mechanism, it is stated that in use a platform is raised until there is just a small gap between the specimen and the apex of the diamond tool, a handle is released, a cam begins to revolve and the plunger carrying the diamond falls, with the result that the load on the beam is transferred to the diamond point. A rubber pad eliminates the transmission of the inertia effects to the indenting tool. A clockwork mechanism governs the period of application of the load—the first five seconds are absorbed in taking up the gap between the work and the diamond. During the succeeding eight seconds about 40 kilos of the load are applied to the specimen, the last eight or ten kilos are applied during the succeeding five seconds. During the remaining ten to twelve seconds the load is held on the specimen at the value now reached, namely at about 20 kilos. The conclusion of the last period is indicated by a "click" in the mechanism indicating the automatic release of the load, whereupon the operator may reset the apparatus by means of a pedal.

As is well known, the results from the Brinell hardness test are apt to vary with the length of time the load is on but this Vickers machine gives a standardization of time period.

The impression left is square and not the Brinell circle. The length of the diagonal is read from a scale on a microscope conveniently attached to the machine and by means of a table can be directly converted into hardness figures.

One incidental advantage of the use of the pyramid form of diamond is that across the corners of the impression where the measurement is taken, no lip is turned up and hence one complication of the ordinary Brinell test is eliminated.

Specimens from the thinnest up to a thickness of 13 in. can be accommodated and the load can be varied from 10 kilos up to 100 kilos.

Satisfactory measurements of the tensile strength of the specimens may be made by multiplying the figure by a constant factor.

There are two photographs of the machine in use and one diagram of the mechanism. *The Engineer* (Eng.), Sept. 12, p. 286.

American Machinist
Established 1877
KENNETH H. CONDIT AND FRED H. COLVIN, *Editors*

Secretary Hoover on Government Ownership

RADIO listeners, a few nights ago, heard what was probably the most masterly attack ever delivered on government ownership and its attendant evils. Secretary Hoover in his address lived up to his reputation as one of the world's greatest economists. If you did not hear him or read the full text of the speech as published in the daily press on the following morning, you owe it to yourself as a voter to get a back file of your morning newspaper and read what he had to say.

Few Americans have imaginations vivid enough to visualize the real meaning of government ownership of all public utilities as proposed by Senator La Follette and his associates. Some Europeans might, by reason of their own sad experience, come somewhat closer to the truth, but even they would be handicapped as their own experiments in government ownership have been petty as compared to the tremendous scheme of La Follette.

Imagine if you can the 530 members of Congress or the hundreds of members of State legislatures suddenly becoming the boards of directors of vast corporations capitalized at forty billions of dollars and employing two million seven hundred thousand workers! Perhaps you can form a mental picture of the political steam roller that would spring into being and of the graft and corruption, the deadly red tape, the hopeless inefficiency and lack of initiative that would result. We don't care to try—the idea is too horrible.

Suppose further that you try to see what would happen to our telephone system or our railroads if every job were based on rigid civil service requirements and seniority governed advancement. As Mr. Hoover says, it is one thing to choose a postmaster but another to choose a railroad president.

Among other evils that would certainly follow in the train of government ownership are an immediate increase in taxes, because the $600,000,000 paid by the utilities to Federal and local governments would cease, that would be a catastrophe to the smaller communities; the creation of another political bloc, because the employees of the government-owned utilities would have to go to Congress for an increase in wages or a betterment of working conditions; the smothering of invention, because the incentive would be gone.

The Secretary's peroration was powerful. He said:

"We have constructed our government upon the theme that its major purpose is to preserve human liberty amid the changing social and economic scene. If we divert it to the changing of money we shall have lost sadly for the future.

"We are asked to abandon all that we have builded as a land of opportunity by injecting into it an economic patent medicine from Europe. Socialism may have a place with some of the nations of Europe because of their failures to provide freedom, opportunity, and service. It has no place with us. We are building here a form of social organization of our own. We differed with European ideals 300 years. We have today in America the widest extended and most effective method of controlling abuses. We contribute more to invention and improvement than all other peoples combined. We are asked to abandon all this and embrace new social ideas, increase our cost of service, decrease our national efficiency, undermine our democracy, destroy the fundamentals upon which our nation has become great. This is not progressive, for it is not progress. It is destruction."

What of Research?

TO BUILD a skyscraper without knowing the nature of the soil on which it is to rest would be considered foolish. To take a large steamer out on a trip without knowing the depth of the waters to be traversed, without knowledge of reefs and rocks, of currents and prevailing winds would be considered . . . . No, it would not be considered at all.

The idea of ascertaining fundamental conditions before action is taken, of research before building begins is well established. Spinners and weavers know much of the qualities of cotton, and try to find out more; steel makers study their product from the metallurgical standpoint; makers of electrical machinery spend large sums of money for a better understanding of the laws of electrical phenomena and there has been a never ending research into the qualities of steam ever since the steam engine was invented.

More important than any of these industries is the Machine Tool Industry, for without it the others would still be where they were 200 years ago—or not at all. And yet nothing has been done by this industry, as an industry, in the direction of fundamental scientific research into the action of various metals as they are cut or formed. Isn't it about time to make a start?

Just Suppose

JUST suppose some grocer with many customers in outlying districts complains that his trade is falling off because his competitor uses an automobile for delivery and he has to depend on an old horse, and that with the poor condition of trade he can't afford buying a machine; wouldn't you point out to him that he is a little late with his complaint, and that he should have bought the auto when trade was still good? Wouldn't you tell him that now he is experiencing the result of letting his competitor steal a march on him?

Now suppose the owner of a machine shop tells you that he cannot afford to buy new machinery because he is not making money. He is losing it, he says, and can no longer compete with the other fellows who have new and up-to-date equipment and are making such good profits that they can quote better prices. Wouldn't you tell him that he is a little bit tardy with his conclusions?

Well. you say, but no up-to-date grocer would think of using an old horse for deliveries.

No, of course not, but

Just suppose.

Shop Equipment News

Reed-Prentice Hollow-Spindle Lathe

The Reed-Prentice Co., Worcester, Mass., has recently developed and is now marketing a hollow-spindle lathe. The spindle construction permits the telescoping of work inside the headstock, so that the extended end of the work can be driven close to the cutting point. The machine is especially adapted for the machining of automotive crankshafts, armature shafts, and similar work in which it is of advantage to reduce the overhang.

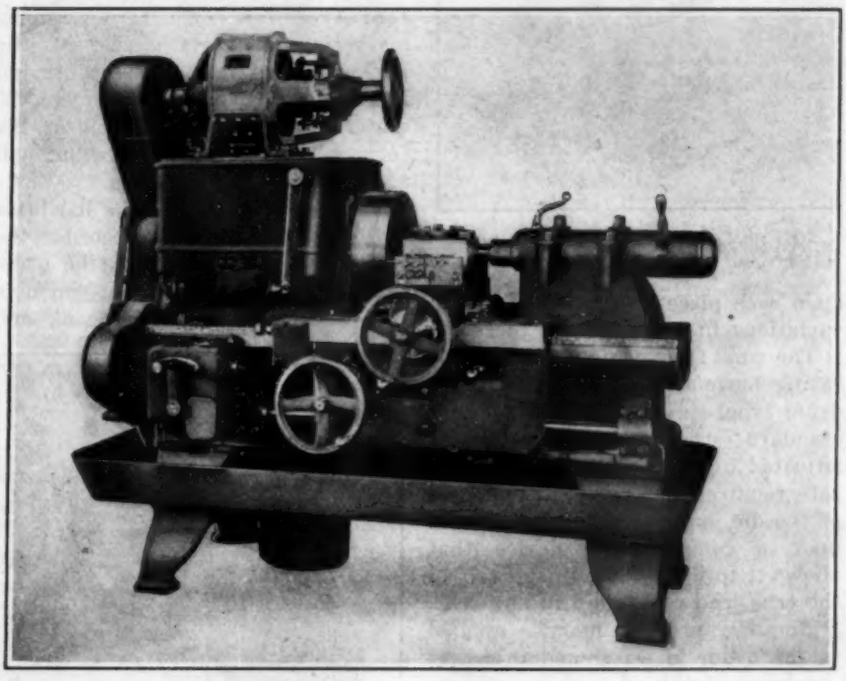


Fig. 1—Reed-Prentice Hollow-Spindle Lathe

The construction is sufficiently rugged to allow heavy cutting by both front and rear tools. Three methods of mounting an automobile crankshaft for the machining of various sections are shown in Fig. 2. The arrangement at *A* is used when the flange end is to be machined. The crankshaft is supported between the head and tail centers and driven by a special chuck that grips the crankpin adjacent to the portion being machined. The hollow-spindle construction permits the complete telescoping of the crankshaft in the spindle, thereby furnishing a good support for the work and allowing the location of the chuck driver on the spindle flange with little overhang.

In this case the rear tools are used to turn the flange bearing and its shoulder, together with the outside diameter of the flange. The surfaces finished by the front tools are indicated. A special rear slide construction puts the down pressure of the cutting on the front block. Both front and rear tools operate simultaneously. The chuck has a large opening for convenient loading. The sliding bell-mouthed sleeve inside the hollow spindle locates the work on the headstock center.

An arrangement for machining the small end of the crankshaft is shown at *B*. In this case, also, the entire crankshaft is telescoped in the hollow spindle and driven close to the portion being machined. The rear tools perform the turning operation while the front tools are facing.

For machining the center bearing the work is mounted as shown at *C*. The crankshaft is driven by the crankpin nearest the center bearing and the rear tools turn the diameter. The front tools face the cheeks and round the fillets at each end of the bearing. The lathe is entirely automatic in its cycle of operations, including the control of diameters and length of the work.

The headstock is of box construction to accommodate the hollow spindle. The hole in the spindle is large enough to admit all standard makes of automobile crankshafts. A disk clutch and a brake are located in the drive at the back of the head and are used for starting and stopping the spindle. A single lever at the front of the headstock operates the clutch.

The gears in the head are of hardened steel and of the herringbone type. With the exception of the spindle, all the shafts of the head are mounted in ball bearings. The machine can be arranged for either belt or motor drive, the machine illustrated in Fig. 1 being

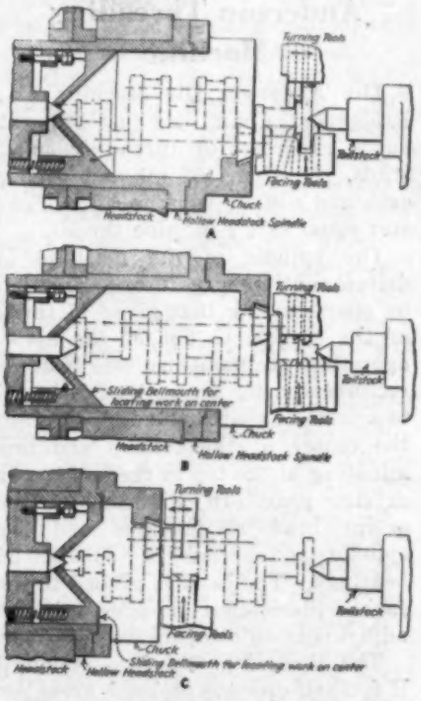


Fig. 2—Crankshaft set-ups on hollow-spindle lathe

motor-driven. The motor drives through hardened herringbone gears and all gear shafts run in ball bearings. The motor capacity required varies from 5 to 20 hp., depending on the class of work.

The cam tailstock provides for quick withdrawal of the tail center and fine adjustment of the center in the work. The carriage bridge is supported on a right-angle bearing inside the bed and directly under the front tools. Power longitudinal and cross feeds are available and either may be engaged separately. Both feeds are automatically operated and tripped in both directions, the direction of feed being determined by the position of a hand lever at the front of the apron.

A plain T-slot tool block is regularly furnished, and front and rear blocks of various types can be provided for special work. A patented back arm attachment can be used for facing and chamfering operations. The regular feed box provides four feeds and the compounding of standard gears at the head of the machine gives three additional feeds. The changing of the feed gears is accomplished by means of a crank handle at the front of the box.

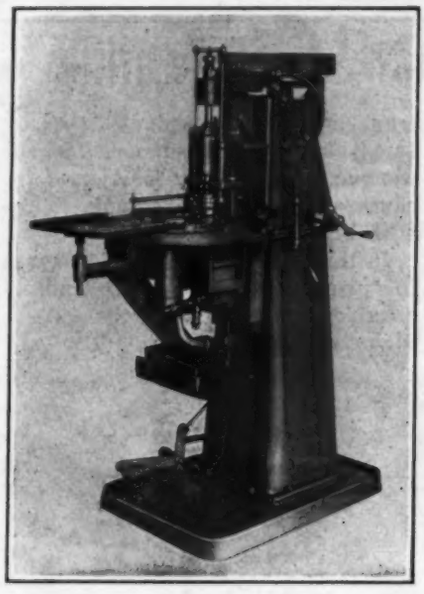
The headstock has a splash-feed lubrication system. The apron bearings are lubricated through pipes from an oiler at the top of the carriage.

Anderson Threading Machine

The Anderson Die Machine Co., Bridgeport, Conn., has just brought out a machine for threading small studs, the stems of oil and grease cups and similar work up to a diameter equal to a ¼-in. pipe thread.

The spindle of the machine is driven continuously in one direction by spur gearing that gives 15 turns of the spindle to one of the cycle-operating mechanism. The head is reciprocated by a cam that is keyed to a vertical shaft extending through the center of the column and terminating at the top in the large spur driving gear. In this machine the entire head reciprocates and the spindle is carried in substantial bearings. The head is gibbed to the face of the column and provided with adjustment to compensate for wear.

The threading tool is a standard H & G self-opening diehead, arranged to release at the proper point by the movement of a rod that extends through the spindle and contacts with the end of the work inside the die. This rod may be adjusted for position at the upper end of the spindle. This method of tripping the die insures that there shall be an equal number of turns of thread upon each piece regardless of minor variations in length of the pieces.



Anderson Threading Machine

The cam from which the reciprocating movement is taken is of the drum type, similar to those used on standard screw machines. It is adjusted to advance the head at the rate required by the speed and lead of the die, but the latter is mounted upon a compensating device that allows it to float and adjust itself to the true lead of the die in any case. Different cam-shoes may be applied to the drum to accommodate different leads of thread.

The work is fed to the threading position by means of a dial, operated by a ratchet and pawl movement. Cut-out openings, conforming roughly to the shape of the work, are made in the periphery of the dial, and the operator sets the work-pieces in these openings by hand. As the work comes under the threading die it passes between the jaws of a vise, one jaw of which is moved by means of a cam on the central shaft. This jaw closes upon the work and holds it against turning by the die.

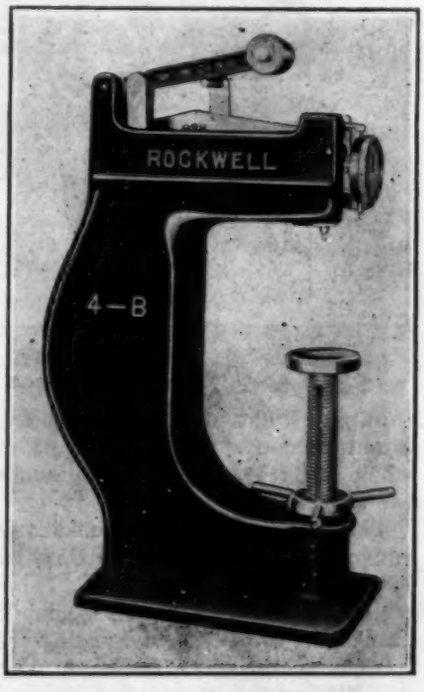
As the work passes beyond the threading position a knock-out, attached to the sliding head, pushes the piece out of the dial if it has not already fallen out. Both the knock-out and the pawl that feeds the dial are spring-suspended in such a manner that only the pressure of the spring is exerted against the work. If any mishap occurs to prevent the dial from rotating or the work from being pushed out of any opening, there would be no danger of breakage to the machine.

The machine occupies a floor space approximately 2x3 ft. and weighs 800 pounds. It is driven by a motor enclosed within the column. Oil is supplied to the die through the hollow spindle by means of a pump, also located within the column. A settling tank is provided for the oil in the base of the machine.

Rockwell Model 4-B Hardness Tester

The Wilson-Maeulen Co., 383 Concord Ave., New York, N. Y., is now marketing a larger model of the Rockwell hardness tester, designated Model No. 4-B. This instrument operates on the same principle as the former models of the device but will accommodate larger pieces.

The device measures the hardness by penetration and records the resistance of the metal to the penetration of the test point upon a direct-reading dial. The loads and penetrators are the same as for the smaller models and the hardness scale is also the same. The instrument will test pieces up to 12 in. thick and to a distance of 7½ in. from the edge.



Rockwell Model 4-B Hardness Tester

Lodge & Shipley 12-In. Toolroom Lathe

Among the features of the toolroom lathe recently placed on the market by the Lodge & Shipley Machine Tool Co., Cincinnati, Ohio, are a motor drive in which the motor is carried on a swinging plate; a belt-shifting device; a "universal" relieving attachment; multiple-plate disk clutches in the apron and headstock; and push-button control.

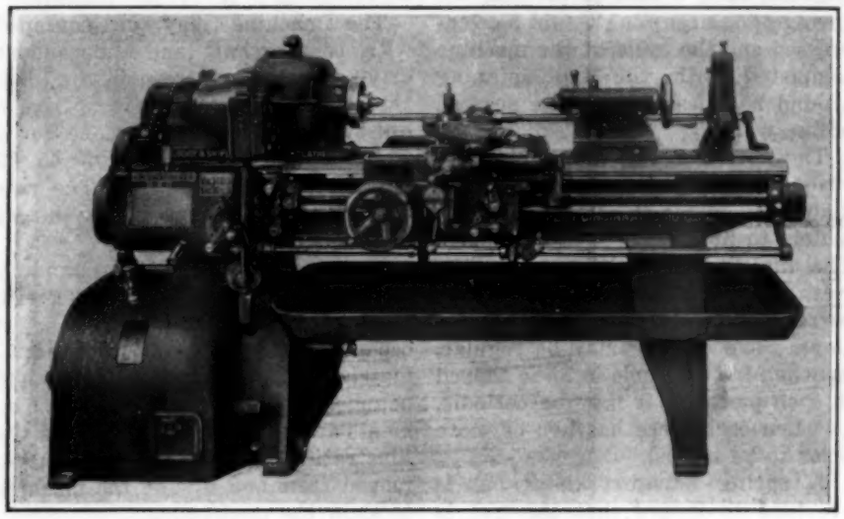


Fig. 1—Lodge & Shipley 12-In. Toolroom Lathe

A view of the front of the lathe is shown in Fig. 1. The machine is of the 12-in. size with 3-step cone and double back gears, and swings 14½ in. Eighteen spindle speeds are available. It is driven by a 3-hp. motor bolted to a plate that is free to swing through a small arc about a shaft supported in the motor housing under the headstock.

The drive is direct from the motor to a ball-bearing countershaft and the belt from the countershaft to the machine passes over a ball-bearing idler. The tension of the belt is maintained by the weight of the motor, motor plate and countershaft. A treadle affords means for swinging the motor plate about the supporting shaft to relieve the belt tension when shifting. The shifting mechanism is operated by a lever convenient to the operator's left hand.

The relieving attachment may be seen in both Figs. 1 and 2. It is called "universal" because any relief within the range of zero to ⅞ in. can be cut in any position on the circle and with any position of the compound slide; and because plain, angular, end, interval and spiral relieving can be done. The attachment can be operated at any position along the bed. The amount of relief is controlled by a pinion at the side of the compound rest and can be varied without stopping the lathe. The pinion shaft is graduated, can be turned by hand and is locked in position. A single-lobe cam is used to give the relief.

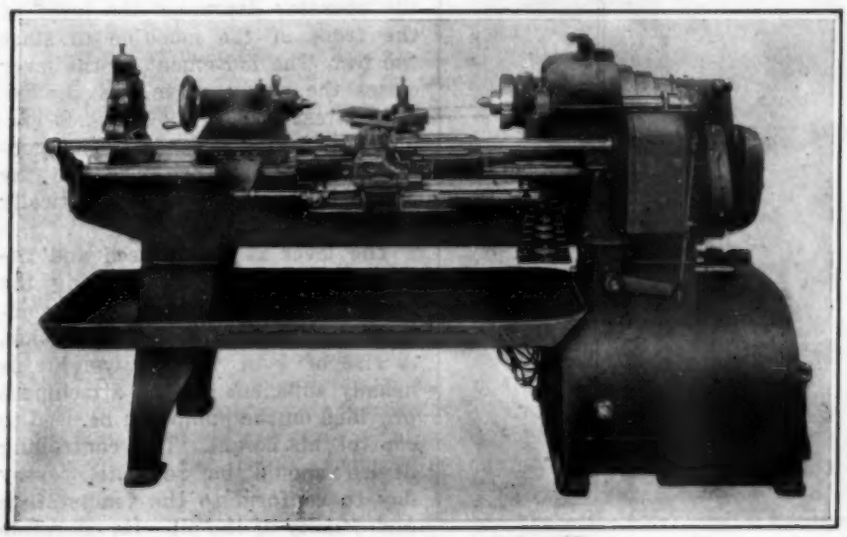


Fig. 2—Rear view of Lodge & Shipley lathe, showing the relieving attachment

The method of driving the relieving attachment permits hobs with leads as coarse as 4 in. to be relieved. When the attachment is not in use the drive may be directly connected to the regular thread gearing and threads as coarse as 4 in. can be chased. The effective range in screw cutting is from 128 threads per inch to a 4-in. lead, and feeds as fine as 0.0025 in. can be obtained.

The entire relieving attachment is located at the rear of the lathe. Power is obtained from a sliding gear on the back-gear shaft. It is carried through a train of gears to the change-gear box and thence to the splined shaft, from which it is transmitted to the camshaft through a pair of spiral gears and a pair of bevel gears. There are no universal joints. Nine loose change gears are provided, which make possible the relieving of cutters with from 3 to 24 flutes.

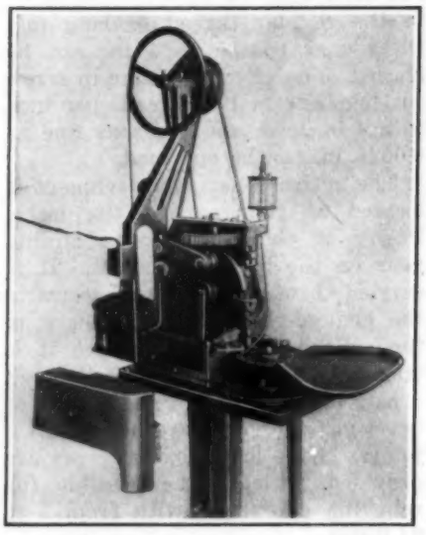
Longitudinal and cross feeds are thrown in and out by a single lever that operates the multiple-plate clutches in the apron. Change of feed from longitudinal to cross and vice-versa cannot be made without throwing a safety stop. Direction of feed is controlled by a lever on the apron. Automatic disengagement of the longitudinal feed is provided.

Reverse of the spindle is obtained by reversing the driving motor, operating it through the push-button control. The spindle drive is thrown out by a slight movement of either control lever, one located at the headstock and the other on the apron, and a further movement of the lever applies a brake.

Hart & Hegeman Tapping Machine

Purinton & Smith, Hartford, Conn., have taken the exclusive agency to handle the Hart & Hegeman small-hole tapping machine and it is now available for the market. The machine was originally developed by Hart & Hegeman for use upon their own work, and is the outcome of long experience in tapping the small parts of electric switches and similar devices produced by them.

The tapping spindle is driven by a spur gear at the top of the machine, this gear being in turn driven by a bevel-gear segment. The oscillating movement of the segment is produced by a connecting rod and rock-shaft from a Whitworth crank located on the opposite side of the machine frame. The Whitworth crank is similar to that applied to many of the older type of shapers, making the forward motion of the spindle slow



Hart & Hegeman Tapping Machine

and uniform and providing a relatively quick return. This action permits the greater part of the cycle time to be used for the actual tapping.

The spindle is in two parts, connected together by a floating telescopic coupling that may be disconnected when it is necessary to exchange one spindle and nut for another. The bearing of the upper part of the spindle is a long bronze nut into which the spindle itself is threaded to give the up-and-down movement without cams or similar devices. The bearing and spindle ordinarily furnished has a 20-pitch thread which adapts the machine for any number of threads between 16 and 24 per inch. This range covers practically all work for which the machine is intended. Spindles and nuts of other pitches are provided, when necessary, to change the range of work.

The lower part of the spindle runs in a plain bronze bearing that allows free endwise travel. The telescopic coupling provides a spring suspension in both directions, so that the tap may run ahead or lag behind the advance of the upper member, according to whether the lead of the tap is greater or less than that of the spindle. The advance of the lower member is thus determined by the tap, while the upper member supplies a constant rotative drive. An advantage of this construction lies in the fact that if the tap should encounter a piece of work in which no hole had been drilled or pierced, the spring of the coupling would be compressed and the cycle of the machine completed with the tap spinning around harmlessly upon the surface of the work.

The work is fed to the tapping position by means of a ratchet-operated dial with openings shaped approximately to fit the pieces to be tapped. The dial itself is the ratchet, the teeth being cut in its periphery to correspond with the tapping positions. The spacing may be regular, as when but one hole is to be tapped in each piece; or it may be periodic, as when each piece has two or more holes to be tapped.

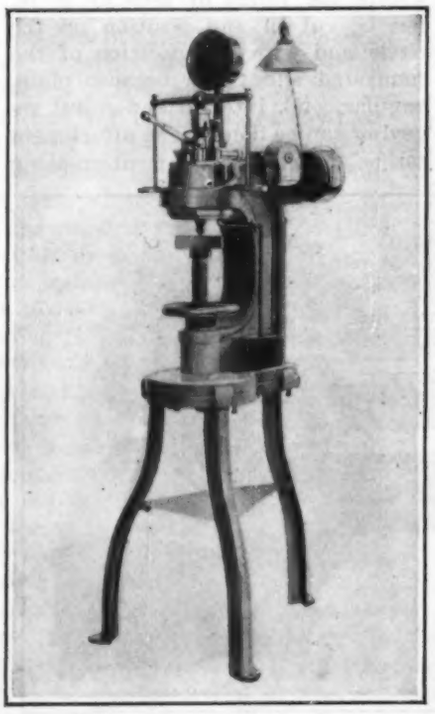
A spring-actuated knock-out is provided to insure that the dial is kept clear although the finished pieces will usually drop out. A safety clutch is connected to the pawl so that if it should for any reason fail to enter the proper notch the machine will be stopped before the indexing movement takes place, and with the tap at the upper limit of its stroke.

The machine may be equipped with countershaft and independent driving motor as shown in the illustration, or it may be driven from a line-shaft. A three-step cone for a round belt is provided, giving 45, 65 or 85 cycles per minute. The rate can be varied by providing larger or smaller driving pulleys.

The machine is designed primarily to tap holes up to ¼-in. diameter with from 16 to 24 threads per inch. It occupies a floor space of approximately 2x3 ft. and weighs 440 pounds. All gears and major movements are guarded. As shown in the illustration, the guard has been removed from one side of the machine to show the mechanism.

Pittsburgh Power-Operated Brinell Tester

With the increasing necessity of testing large numbers of machine parts in certain industries, the Pittsburgh Instrument & Machine Co., 1026 Reedsdale St., Pittsburgh, Pa., has recently developed and placed on the market a power-operated Brinell hardness testing machine. This device will give a larger output than the former hand-operated model.



Pittsburgh Power-Operated Brinell Tester

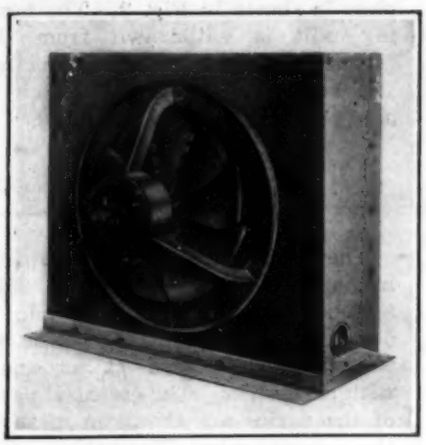
The essential features are the same as in the hand-operated machine. It is stated that one power-operated machine can test as many pieces as could formerly be handled by five hand-operated models. A ¼-hp. motor furnishes the power for driving the machine and can be connected to any convenient light socket.

The motor drives the pump through a worm and wormwheel, and the operator depresses the lever at the front of the machine to start the test. The movement of the lever closes the needle valve and the required test load of 3,000 kg. is created in a few seconds. The controlling weights then rise and the action of the pump is automatically disengaged.

The lever is then raised and the needle valve opens, permitting the removal of the test piece for reading the diameter of the impression. A rise of ½ in. for the weights is usually sufficient and an attachment provided on the pump can be used to control this height. This controlling device should be regulated every day to conform to the temperature and density of the oil. Its operation is very simple and occupies but little time.

Buffalo "Breezo-Fin" Unit Heater

For heating machine shops, garages and other industrial establishments where steam or hot water is available for heating purposes, the Buffalo Forge Co., 490 Broadway, Buffalo, N. Y., is now marketing a



Buffalo "Breezo-Fin" Unit Heater

unit heater under the trade name of "Breezo-Fin." The design of the apparatus is characterized by its light weight, a special fan to insure good air distribution, and compactness.

The component parts of the device are a series of heater tubes, a unit casing, a fan and a motor. The heater tubes are of copper and are wound with a copper ribbon to increase the radiating surface of the coils and give rapid transmission of the heat to the air. The heating unit is designed for operation on any pressure up to 50 lb. per sq. inch.

The fan has ten cup-shaped blades, the blades being designed to give uniform distribution of the current of air over the heating coils. A low-speed motor operating at 850 r.p.m., or a motor to run at 1,150 r.p.m., can be supplied. The slower speed is used only when very quiet operation is desired. The method of attaching the motor and fan to the casing is shown in the accompanying illustration.

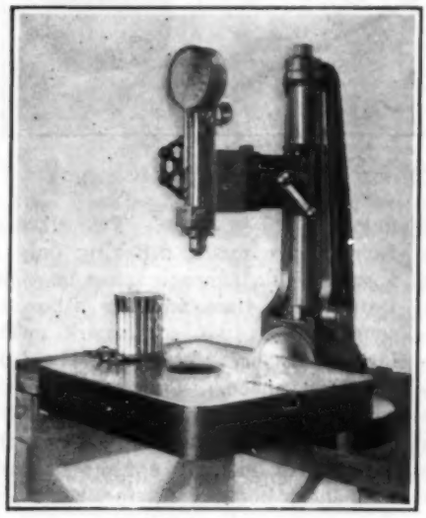
At the slower speed the 18-in. unit will handle 1,625 cu.ft. of air per min., with a temperature rise of from 60 to 90 deg. F., depending on the temperature of the entering air. The other arrangement transmits 2,125 cu.ft. of air per min., with approximately the same temperature rise.

The casing of the apparatus is of galvanized steel, into which the header is keyed in such a manner that any stress imposed by the movement of the piping or the unit itself is borne by the casing. Suitable angles and baffles are provided to prevent the air from by-passing between the headers or between the side tubes and the casing. The units are standardized, the 18-in. unit being illustrated. A thermostat can be furnished for automatic temperature regulation.

Shore Improved Non-Portable Scleroscope Set

A non-portable combination of a clamping stand and a separate swing arm and post, for use with the scleroscope, is now being marketed by the Shore Instrument & Manufacturing Co., Van Wyck Ave. and Carll St., Jamaica, N. Y. These units were incorporated in a former portable model of the scleroscope set, and the scleroscope fitted to the later model is the same as used in the former.

The apparatus shown in the accompanying illustration has been increased in sizes over the former portable model to accommodate large work. The heavy tilting table can be set at any angle and is graduated for accurate setting. For testing specimens having a part that must extend through the table, a removable center anvil is provided.



Shore Improved Non-Portable Scleroscope Set

The swinging arm is mounted on ball bearings and is rigid enough to permit clamping down the specimen. The use of the apparatus eliminates the necessity for most of the special holding fixtures otherwise required for testing of odd-shaped pieces.

"Sico" Automatic Actuator for Model C-1 Scleroscope

A recent addition to the line of hardness-testing apparatus manufactured by the Shore Instrument & Manufacturing Co., Van Wyck Ave. and Carll St., Jamaica, N. Y., is the

"Sico" Automatic Actuator for Model C-1 Scleroscope

"Sico" automatic actuator for operating the Model C-1 scleroscope. This device is designed to relieve the operator of the necessity for muscular effort, except that of pressing a small trigger, when the scleroscope is continuously operated on mass production.

The actuator is shown at the right in the accompanying illustration, attached to the scleroscope by means of a rubber tube. It consists of a small motor-driven pump that runs continuously and has the same suction and compressive force as the usual rubber bulb in the hand of the operator. The motor operates at the proper speed for operating the scleroscope in ordinary service. In the rubber tube a trigger-operated control valve is located, together with a holding ring that slips over the operator's finger.

When using this device a succession of tests can be made without the use of the trigger, except to hold it drawn in, the air connections being made by the motor. The operator may thus pass the scleroscope over the surface to be tested and determine the uniformity or the average hardness. The timing for drawing up the hammer, the release and the rebound, is done automatically by the speed of the actuator. This is so arranged that the hammer is drawn up after each rebound and will not fall back.

Eaton Rotary Electric Furnace

The Eaton Electric Furnace Co., Taunton, Mass., has recently brought out an electric furnace of the rotary type for tempering small drills, taps, etc., in production quantities.

The body of the furnace is a horizontal cylinder of steel plates with cast-iron ends. Eight inches of insulating material surrounds the heating chamber on all sides. The electric heating unit is carried in a semi-circular frame in the lower half of the chamber, with leads passing through the rear head and connecting with bus-bars.

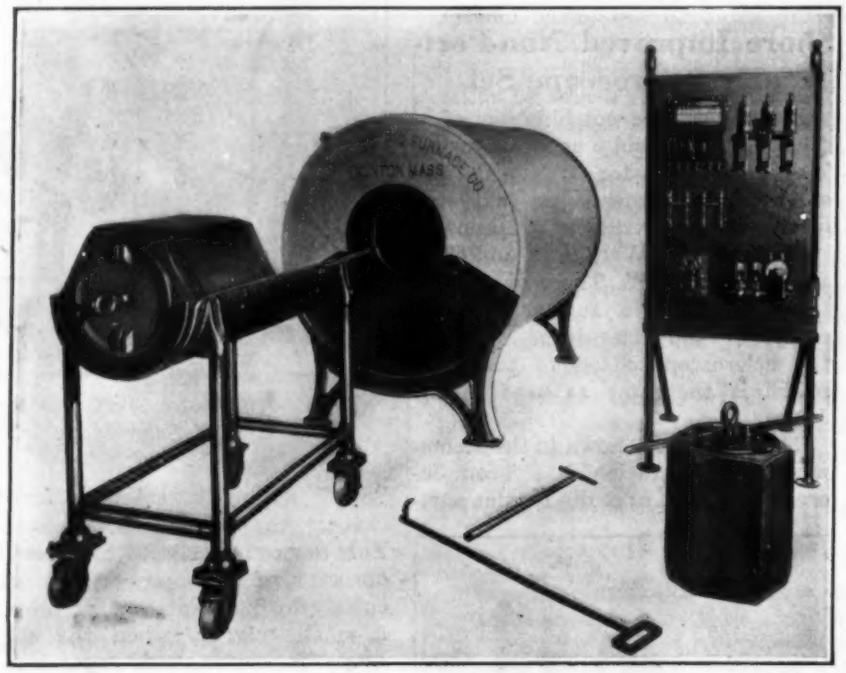


Fig. 1—Eaton Rotary Electric Furnace

A rotating cradle occupies the center of the furnace. It is open at the front end and closed at the rear end by a spider to which a short shaft is attached. The shaft extends through the rear wall and is supported in a ball bearing. The front end of the cradle rests upon two rollers on the outside of the front wall.

The cradle is kept in continuous rotation at a rate of 1.3 r.p.m., being driven through differential gearing by a small motor that runs at 1,750 r.p.m. The work containers are hexagonal chambers of cast-iron, each fitted with a removable cover fastened in place with a bayonet locking device, so that it may be released by giving it a partial turn forward. The containers are entirely separate from the furnace and are loaded and sealed while still on the floor.

In Fig. 1 one of the containers is shown on the floor and another on the loading truck, both with the covers in place. After the containers are in the cradle the latter is closed by another cover that attaches in the same manner to the cradle itself.

The containers are 14 in. across flats and 36 in. deep. Two sizes of furnace are made, differing only in length. One furnace takes one container at a time and the other accommodates two containers. The larger size occupies about 4½x6½ ft. of floor space. The entire outfit comprises the furnace, several of the containers, the loading truck, the panel with electric equipment, and wrenches, hook, etc., for removing the covers and containers.

Automatic pyrometric control maintains any desired temperature up to 800 deg. F. The cradle rotates continuously during the period of operation, the movement being slow enough not to interfere with the removal and replacement of containers and cover.

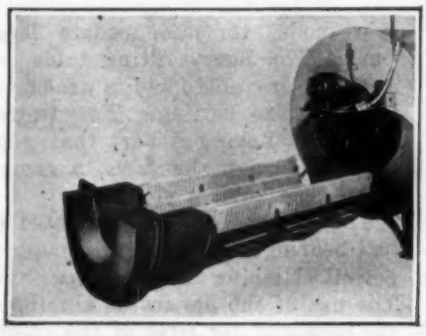


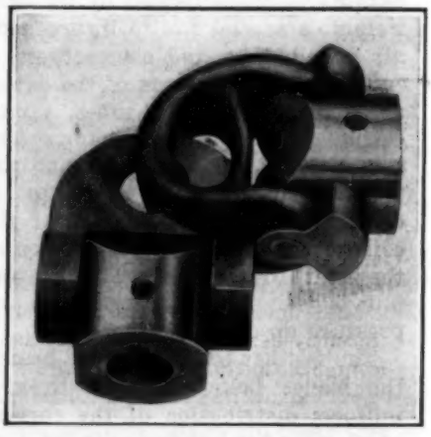
Fig. 2—Eaton electric furnace with heating unit withdrawn

The rear of the furnace with the driving motor and reduction gear in place is shown in Fig. 2. The heating unit is withdrawn from the furnace to indicate its construction and show the ease with which it may be taken out and replaced.

Bartlett Angular Transmission

The angular transmission now being marketed by G. M. Bartlett, 2533 College Ave., Indianapolis, Ind., is designed for transmitting power between shafts located at an angle with each other. The essential parts of the device are shown in mesh in the accompanying illustration.

The hobs carrying the swivel sections are fastened to the ends of the shafts to be connected. The transmission is said to maintain a uniform velocity ratio between the shafts and to be noiseless and efficient in action. For proper working it is not necessary for the shafts to be precisely in alignment, and the device will also transmit motion satisfactorily between two parallel shafts whose center lines are some distance apart.

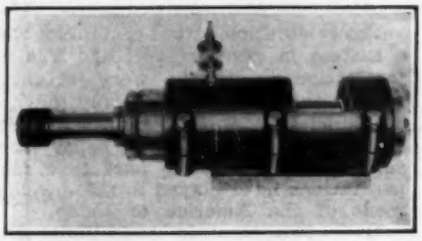


Bartlett angular transmission

The apparatus is regularly supplied without bearings or oil cases. When used in right-angle drives for line shafting, special hangers, self-aligning ball-bearing pillow blocks, and oil cases can be furnished. For small torque at high speeds the hubs can be omitted and the swivel pins can be driven directly through the shaft ends.

Ex-Cell-O High-Speed Ball-Bearing Grinding Spindle

The Ex-Cell-O Tool & Manufacturing Co., 1469 East Grand Blvd., Detroit, Mich., has recently added to its line of ball-bearing spindles for various makes of grinding machines,



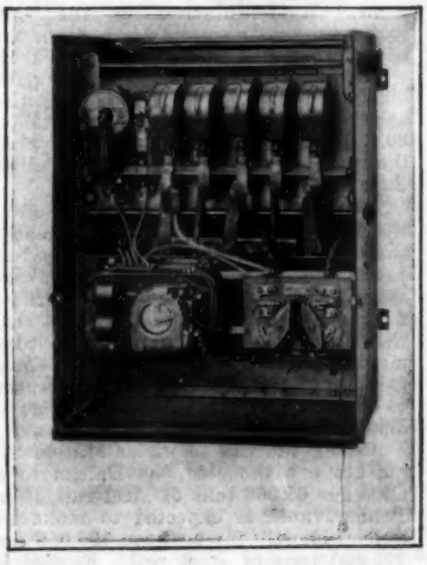
Ex-Cell-O High-speed Ball-Bearing Grinding Spindle

a redesigned type especially adapted for use on Heald internal grinders. The spindle is equipped with three Ex-Cell-O ball bearings.

The bearings are mounted in two bodies or housings in the frame casting. The front housing supports the grinding end of the spindle on two bearings. The rear housing provides an outboard support for the spindle beyond the pulley and is fitted with a single bearing. The distribution of the belt load over the three bearings is said to have advantages in operation and durability over the former model.

General Electric Automatic Starting Compensator

The General Electric Co., Schenectady, N. Y., is now marketing a recently-designed automatic starting compensator for squirrel-cage induction motors, designated type CR-7051-J1. This starter is for the remote control of two- or three-phase motors up to 600 volts, when used in general applications such as driving line shafting, pumps, compressors, conveyors, etc. The motor may be started at a distance by push-button or snap switches within convenient reach of the operator, or automatically by switches actuated by pressure governor, float switch, thermostat, etc.



General Electric Automatic Starting Compensator

Definite and adjustable time acceleration is obtained by means of an improved induction-type relay. Positive overload protection of the complete equipment is furnished by a double-pole, inverse-time, temperature relay. The starting and running magnetic contactors are mounted back-to-back in a sheet-steel case that provides convenient access to all parts. Several taps on the auto-transformer provide for adjusting the low voltage for starting to suit the requirements of different installations.

All parts are protected by the steel enclosing case. A conduit case at the back has several knock-outs and furnishes entrance for all power and control wires to the starter.

"Excello" High-Speed Ball Bearing

Under the trade name "Excello," the Ex-Cell-O Tool & Manufacturing Co., 1469 East Grand St., Detroit, Mich., is now marketing a high-speed ball bearing, licensed under the Snader patent application. The bearing is of the combined radial and thrust type and is designed for speeds up to 50,000 rev. per minute.

The bearing is shown disassembled in Fig. 1 and Fig. 2 is a sectional view. The ball races are so located in relation to each other that the balls are given a spinning motion in addition to the motion of rolling around the center of the shaft. This construction is for the purpose of eliminating the wearing of flat spots or tracks on the balls.

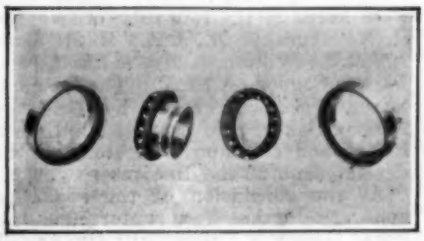


Fig. 1—"Excello" High-Speed Ball Bearing

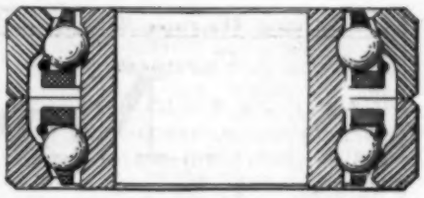


Fig. 2—Cross-section of "Excello" bearing

Since the outer races are at an angle, a worn bearing can be salvaged by grinding the inside faces of the outer rings. If the surfaces of the races are excessively pitted or worn, these surfaces can be reground. Bakelite ball separators are used.

Dutch East Indies as a Machinery Market

The machinery market of the Dutch East Indies is undergoing considerable expansion and deserves the serious attention of the American machinery exporter, according to the Industrial Machinery Division of the Department of Commerce. The growing importance of this market is shown by the increase of over 162 per cent in industrial machinery exports from the United States during 1923 over the preceding year. Figures for the first six months of 1924 indicate that the expansion is continuing this year and that a favorable opportunity exists for the sale of American equipment.

In 1922, the United States shipped machinery valued at $303,230 to the Dutch East Indies. This figure increased to $795,766 in 1923. For the first six months of 1924 American machinery sales have amounted to $512,396, a considerable increase over the 1923 amount. A significant feature of American trade with these islands is indicated by 1921 machinery exports which amounted to over $5,000,000. The potentialities of the market are further shown by 1919 machinery figures showing exports from the United States amounting to over $4,500,000.

Many Lines Improve

In 1922, shipments of mining, oil well, and pumping machinery amounted to $119,466 and to $566,645 in 1923. Gains in exports of oil well drilling apparatus and other oil well machinery played the greatest part in this increase. Further gains are indicated in exports of mining, oil well, and pumping machinery for the first six months of 1924.

An analysis of the six broad classifications of American industrial machinery shows a marked contraction in the Dutch East Indian market for construction and conveying machinery. Exports of this group increased more than 50 per cent in 1923 over the preceding year but declined sharply during the first half of 1924.

News of the Week

Rensselaer Polytechnic Institute Celebrates Its Hundredth Year

Notables of scientific world attend impressive ceremonies

The Rensselaer Polytechnic Institute, in the presence of distinguished guests from all parts of the world, and hundreds of the alumni of the school, celebrated on Friday and Saturday of last week the hundredth anniversary of its founding at Troy, N. Y. This school was the first institution in any English-speaking country to be started for the purpose of teaching the application of science to the problems of every-day life, and to continue its existence to the present. The founder, Stephen Van Rensselaer, was especially honored by the friends and alumni of the school at this gathering, and a bronze tablet commemorating the anniversary was unveiled by a descendant of the founder, Mrs. Elizabeth Van Rensselaer Frazer of Washington, D. C.

The exercises commenced Friday morning with an academic procession from the campus to the State armory, where a large audience gathered to listen to the first speaker, Herbert Hoover, Secretary of Commerce. Mr. Hoover represented the United States Government and brought a personal message of congratulation from President Coolidge. He stressed the importance of engineering education in the solution of problems that face mankind and spoke words of appreciation for the work that the Troy school has accomplished. The next speaker was Frank P. Graves, president of the University of the State of New York, and he was followed by Mayor Clinton of Troy.

Famous European Speakers

Sir Charles Langbridge Morgan, president of the Institution of Civil Engineers of Great Britain, brought greetings from his government and the engineers of his country, and was followed by Henri Abraham, past-president of the Society of Electrical Engineers of France. Luigi Luiggi, president of the Society of Civil Engineers of Italy, then spoke and closed his address by presenting to President Palmer C. Ricketts of the Rensselaer school a decoration as Knight Commander of the Crown of Italy. Words of congratulation and greeting were brought from the engineers of Canada by Arthur Surveyor, president of the Engineering Institute of Canada, and the last address was made by President Ricketts. This was the story of the foundation and early history of the school. Honorary degrees of Doctor of Engineering were then conferred on the foreign representatives, and this ceremony ended the first meeting.

The tablet in memory of Stephen Van Rensselaer and commemorating the centennial was unveiled Friday afternoon. At the conclusion of this ceremony, a second tablet was unveiled as a memorial to Dr. Samuel W. Williams, a graduate of the school in 1832, and at one time Professor of Oriental Languages at Yale. The address was given by Sao-Ke Alfred Sze, Chinese Ambassador to the United States. The tablet to Dr. Williams was presented by the Chinese students and graduates of the school.

The Banquet

The banquet for delegates and alumni in the evening was followed by a pageant depicting scenes from the history of the school. The speakers at the banquet were Dr. Livingston Farrand, president of Cornell University, Dr. Joseph H. Odell, director of the Service Citizens of Delaware, and Dr. H. W. Jervey, dean of the Columbia Law School.

The exercises of the second day commenced in the same manner as those of Friday, the addresses being made by the representatives of educational institutions and engineering societies of the United States. The first speaker was Dr. James R. Angell, president of Yale University, who was followed by Dr. Edward A. Birge, president of the University of Wisconsin. Dr. Samuel W. Stratton, president of Massachusetts Institute of Technology, and Dr. Albert A. Michelson, president of the National Academy of Sciences, were the next speakers. The engineering societies of America were represented by their presidents and they were heard in the following order: Dr. C. E. Grunsky, A.S.C.E.; F. R. Low, A.S.M.E.; William Kelly, A.I.M.E.; and Farley Osgood, A.I.E.E. The concluding address was made by Dr. Ray Palmer Baker, professor of English at R.P.I., and continued the story of the development of the Institute.

At the conclusion of the speaking, honorary degrees were conferred as follows: Doctor of Philosophy: Dr. Angell, Dr. Farrand, Dr. Birge and Dr. Stratton; Doctor of Science: Dr. Michelson; Doctor of Engineering: Dr. Grunsky, F. R. Low, William Kelly, Farley Osgood.

A reception to the delegates and alumni was given by President and Mrs. Ricketts in the afternoon and the alumni of the school also attended an alumni meeting and renewed old acquaintances at a smoker in the evening.

The celebration of the centennial was a success in every respect and was an inspiration to all who were fortunate enough to attend. It not only marked the hundredth anniversary of a great school, but also brought home more forcibly than ever the part that such institutions have played in the development of the America of today.

Over two hundred educational and scientific institutions in all parts of the world were represented by delegates at the exercises during the two days of the celebration.

This is probably the first time that so large and distinguished a gathering has been brought together to honor the engineering profession in this way, and the celebration marks the successful achievement of the engineers of America, as well as the completion of a hundred years of continued existence by the Rensselaer Polytechnic Institute.

Railroads Plan Large Expenditures

The New York Central R.R. will place orders for more than $27,000,000 of new equipment and steel rails within the nexet few months, it was recently announced.

These purchases, according to information in the financial district, will include approximately 7,500 freight cars, at least fifteen locomotives and between 150,000 and 180,000 tons of steel rail. Inquiries for the steel rail are already in the market and the New York Central is expected to put out inquiries shortly for the new equipment. Representatives of the railroad said that requests for bids on the new equipment had not yet been placed.

The New York Central in asking for bids for 150,000 tons of steel rail also asked for the option on an additional 30,000 tons should it be decided that the company wants 180,000 tons rather than 150,000 tons.

As the result of large purchases in the last few weeks, it was estimated that the railroads of the country had purchased 100,000 new freight cars since the first of the year. If these figures are correct, they indicate that the purchases during the first nine months of the year were about equal to those of 1923. There is every reason to believe they will continue at a similar rate for the rest of the year.

Among the rail inquiries still in the market are those of the Baltimore & Ohio for 65,000 tons of steel rail. The Pennsylvania is expected to make inquiries shortly for between 125,000 and 175,000 tons of steel rail. Earlier in the year the Pennsylvania placed an order for 10,000 steel box cars.

Auto Progress in Other Countries

During the three months ended Aug. 31, imports of passenger cars into England have numbered 2,933; trucks, 388; chassis, 2,209, and parts, to the value of £994,126; together with 627 motor cycles and parts to the value of £8,167, according to a report to the Department of Commerce by Acting Attache Butler at London. Imports of passenger cars, chassis and parts were slightly below those of the previous quarter, but trucks remained at about the same level, while motor cycles showed an increase. During August considerable increases occurred in all classes, due to the removal of the McKenna duties, with France and Italy registering the largest advances. British production was well maintained until recent weeks, but is now falling off under slackening seasonal demand. British exports on automotive vehicles are increasing, owing largely to heavier orders from the Colonies. Trade in low and medium priced cars has been good, and one large producer cut prices heavily to compete with Continental light cars. The market for light and medium trucks is strengthening through greater demand for these types for bus use, and decreasing for heavy trucks.

The French market for automobiles has been relatively quiet this summer in comparison with the earlier months of the year, and production in most of the passenger car factories has slowed down considerably with the exception of three or four plants turning out light weight cars, Assistant Trade Commissioner Ray at Paris advises the Department of Commerce. The latter companies are leading the way in developing mass production methods, which French manufacturers are finding increasingly necessary. Exports of passenger cars during the first seven months of 1924 amounted to 25,546 machines, in comparison with 14,947 during the same period of 1923. Exports have continued strong through August and September and manufacturers having organizations capable of handling foreign business are banking heavily on the prospects held out by the export field.

Smaller Countries Buying

The automotive trade in Porto Rico appears to be in a healthy state, the office of the American Trade Commissioner informs the Department of Commerce. During July and August 307 new automobiles and trucks were registered, all of them of American make, with 214 of this number registered in August.

In spite of Mexico's unfavorable conditions, generally, the automotive trade continues to improve, the Department of Commerce's Mexico City office states. One of the largest importers of automobiles states that each of the last three months has shown an increase over the previous one which in turn was a gain over the corresponding period for the past two years. In this connection, however, it should be stated that July, August and September are looked upon as the peak months in the automobile trade in Mexico City.

The condition of the German automotive industry continues unfavorable and many large automobile plants in the Southwest are reported curtailing operations and reducing the number of workmen, according to report to the Department of Commerce by Commercial Attaché Herring, Berlin. Talk of prohibitory tariffs on imported cars to protect German manufacturers, when the present import restriction are removed, is being revived

Rockford Manufacturers Hear Export Experts

At a luncheon given by the Rockford Chamber of Commerce in the Hotel Nelson, Rockford, Ill., Wednesday, Oct. 1, Charles H. Cunningham, Commercial Attaché at the U. S. Embassy in Havana, and Pedro Cezon, who is connected with the American Manufacturers Foreign Credit Underwriters, Chicago, Ill., discussed our commercial relations with Spain, Cuba and South America and the possibilities for future export business. Mr. Cunningham was stationed in Spain for a number of years and Mr. Cezon is a native of South America.

Mr. Cunningham stated that in spite of the high tariff that has been placed on imports by the Spanish government, American trade in Spain is steadily increasing. In war time Spain became immensely rich through manufacturing supplies for the nations at war and is therefore in position to buy first-class goods. Spain has more natural resources than any other country in the world, in proportion to its size, but has not developed very fast in the manufacturing field. Manufacturing methods in Spain are more inefficient and the bulk of labor is untrained. In order to remedy this situation, the country has been obliged to protect itself with high customs duties, with which all American exporters have had some experience. There are two or three manufacturers of machine tools in Spain, but their product is of inferior quality. The development of Spanish industries, due to the high tariff, however, is bringing about a demand for machine tools in which American manufacturers must benefit. The government is at present appropriating money for extensions to arsenals and ship-yards, all of which is going to mean more equipment. Mr. Cunningham said that he knows of no country where steady commercial development means more to American manufacturers than Spain, and, as a matter of fact, American business there is steadily increasing.

The keenest competition in the Spanish market comes from Germany, however. German equipment is regarded very highly, but the Spaniards have the same regard for American equipment and in some instances it is considered superior. German trade is exceedingly well organized in Spain; the Germans have a better credit system and often allow as much as two years time for payment. German prices have been lower, but prices at the present time are about the same and the Spaniards are gradually learning that American-made equipment is superior and are buying on quality instead of price. This is not only true of machine tools, but it is also true of other American-made goods. Since the depreciation of the franc, French goods have become somewhat popular, but this is not a serious factor.

In speaking of conditions in South America, Mr. Cezon stated that long time credits are the usual thing on that continent and suggested that American manufacturers adapt their selling methods to the customs of the country. The foreign manufacturer is protected, in so far as the matter of getting his money is concerned; if the importer fails to pay his bills, more harm is done to the reputable importer than to anyone else, consequently pressure is brought to bear on the offender by his own countrymen. American manufacturers should remember that the country of Brazil alone is larger than the United States and if one expects to conduct business there successfully, he should have more than one representative.

Lehigh Institute of Research Opens

The Lehigh Institute of Research has been started at Lehigh University, Bethlehem, Pa., for the purpose of research work and the furtherance of science among technical men of that district of Pennsylvania. It is also planned that the laboratory will be of general use as a test station for investigations, but this class of work is not solicited and will be done only for a select few, the results being strictly confidential.

The Lehigh Institute of Research will afford training in research methods to members of the teaching staff of the University, to members of the scientific staff of the Institute, graduate students, and to special investigators temporarily employed for particular investigations.

The first fellowship to be founded for the Institute has been founded by the New Jersey Zinc Co. and is to be known as the New Jersey Zinc Company's Fellowship in Science and Technology.

Business Better, Says Vauclain

"September was a good month, better than August, and October will be better than September," said Samuel M. Vauclain, president of Baldwin Locomotive Works, in a dispatch to the *Wall Street Journal*. 'Our business is the last to feel the impetus of expanding industry. General business is improving and, although there are some slack places here and there, they will soon be eliminated as people realize that things are getting better. There are always some folks who are slow to act but trail in afterward. The business outlook is bright. Increasing car loadings tell the story."

How France Is Faring in Other Markets Where Machine Tools Are Sold

Imports and exports show a favorable balance for the country

It is generally considered that by reason of the increase of manufacturing facilities the machinery and tool industry of France is in no way comparable to what it was previous to the war. The notable progress that it has made is comparable to nothing that had gone before. The war factories re-organized account largely for this and still more the coming back to the fold of Alsace-Lorraine with its highly specialized metallurgical and machinery and electrical equipment industries. The latter is making itself felt more and more forcibly at each summing up of the situation. One has only to cite such firms as the Alsacian Electric Co., the Zornhoff, Schlumberger and de Detrich firms, one or another specializing in textile machinery or wood or metal working machinery to say nothing of at least three automobile plants that are now to the credit of France.

The results of the war, the shortage in manual labor and the economic necessities of the century have played their part in bringing forward as it has never been brought forward before the virtues of mechanical aids to modern life and industry which in a more leisurely period of existence had made only a slight impression on French conditions.

It is a curious, but undeniable proof of this that is to be remarked in the fact that the manufacture of agricultural machinery in France has come to rank immediately after that of the automobile industry so far as the turnover goes.

Machine Tool Imports

The following figures of exports and imports of machinery in its various classifications shows to some extent the growth of demand which perforce, in spite of the increased home output, is an indication of the growing demand. It is not so much a lack of a high standard of living comforts as it was the executing of daily tasks by means that were all but primitive.

The import of machine tools in 1913 was 23,735 metric tons; in 1923 it reached but 12,612 tons. This was virtually a diminution of fifty per cent. Germany's part in the trade of 1923 was 11,908 tons and in 1913 only 3,740 tons. Exports in 1913 were 4,582 tons and in 1923, 6,203 tons. A shrinking import and an increasing export, if physical conditions be otherwise healthy, is to be considered a satisfactory state of affairs.

Navigation prime movers and fixed motors were imported in 1913 to the extent of 12,260 tons. In 1923 the bulk fell to 5,700 tons. Germany was again the chief contributor in 1913. Exports increased, however, to only 2,500 tons in 1923 as compared with 2,000 tons in 1913.

Steam propelled or activated farm and road machinery was imported in 1913 to the extent of 1,716 tons, but fell to 227 tons in 1923, while exportations passed from 509 tons to 726 tons. Locomotives and road tractors exported in 1913 figured for 1,260 tons and in 1923 for 7,990 tons.

Textile machinery imported to the extent of 6,930 tons in 1913 fell to 4,640 tons, while exports advanced from 976 to 4,810 tons due to the active participation of Alsace under the French regime.

Exports of electrical machinery increased from 1,600 tons in 1913 to 2,830 tons in 1923. Equipment and accessories increased from 1,950 to 3,360 tons.

In a brief way these figures indicate the parallel growth of the home machine production. America's participation in French imports has been no less than formerly, though it may have suffered as have all other countries exporting to France from a quasi-German competition where certain reparations in kind in the form of machinery and metallurgical products have been introduced in France under conditions which were entirely abnormal.

For the moment German competition appears to be shut off owing to the fact that prices there have in most cases attained what is called the *prix mondial*, the world market price, of similar product wherever found. Had the French franc remained nearer par, rather than having depreciated to .35 from the standard unit of 1.00, Germany's chances of flooding the French market would have been immeasurably greater. In case of an immediate restoring of the value of the franc, or an appreciable improvement, a policy of tariff protection will undoubtedly be called for by big and little industry alike, either this or Germany will be able to procure raw material in the line of the Lorraine minerals and pay therefore in fiinished products.

Safety Council Meets in Louisville

Enthusiasm ran high at the annual meeting of the National Safety Council held in Louisville, Ky., last week with many sectional meetings at which speakers of prominence in the United States were heard and many subjects discussed. Delegates from all parts of the country and from many different industries were present and all agreed that further steps in safety could be accomplished only when the importance of caution had been impressed upon the individual to the same proportion as it has been impressed upon employers and civic associations.

That an accident means loss of time, hence loss of money and impairment of earning power, with the extreme penalty of carelessness, death, was the general theme of the industrial group meetings. Discussions as to the best means of campaigning for safety were held and various advanced methods already in use were brought up.

A monstrous float parade was held on Thursday afternoon at which time many impressive facts were portrayed.

The following were elected officers of the Metals Section: T. H. McKenney, the Illinois Steel Co., Chicago, chairman; A. C. Gibson, the Spang-Chalfont Co., Pittsburgh, vice-chairman; Fred Bennett, the Buckeye Steel Castings Co., Columbus, Ohio, secretary.

Conference Board Will Investigate Prices

The first attempt to investigate the level of prices received by the American manufacturer for his goods has been undertaken by the National Industrial Conference Board, 247 Park Ave., New York City. Its ultimate purpose is to develop an index of factory prices for a large number of representative manufactured commodities, a highly important economic indicator now lacking in basic industrial information. When such an index is completed, it will be possible for the first time, says the board, to compare the trend of these changes with the trend of wholesale and retail prices. Such a comparison, it is hoped, will provide manufacturers with a much needed guide to the adjustment of prices and the elimination of waste.

It was announced at the offices of the board that the program is already under way for the years 1914, 1919, 1921, and as data become available, for 1923.

Gov. Hartness Predicts Shorter Work Day

The third annual meeting of the American Construction Council was held last week at the Hotel Biltmore. Frankling D. Roosevelt, who was re-elected president of the Council, presided during part of the session, but relinquished the chair to take a train for Georgia.

James Hartness, president of the American Engineering Council and former Governor of Vermont, who spoke on "Prosperity Through Industrial Teamwork," listed a number of "fundamental facts" relating to industry, among which he included a prediction that eventually workers would have a five-hour day.

Charles G. Edwards, president-elect of the National Association of Real Estate Boards, said that there was faulty construction of buildings throughout the country Those responsible for this condition, he asserted, include architects, material manufacturers, contractors, workmen, public officials, lenders of capital and real estate brokers.

Addresses also were made by D. Knickerbacker Boyd of Philadelphia, an architect, who was re-elected vice-president; Charles T. Main, engineer, of Boston; John W. Cowper of Buffalo, vice-chairman of the Joint Conference on Standard Construction Contracts, and Willard H. Cobb, vice-president of the National Surety Co., who read an address on contractors' bonds, prepared by William B. Joyce, chairman of the company

Notes of Washington Activities

By Paul Wooton

Characterizing the Dawes plan as a boon to the world, "without a liability in it," an authority in an unexcelled position to judge believes the industrial activities it will promote will result in greatly increasing markets for our agricultural products, while the greater volume of German goods in the channels of world trade is not likely to affect us seriously.

As things are shaping, keenest competition will arise in iron and steel. Plants in the Ruhr have been re-equipped and brought up to the most modern form, because the situation has been such that profits could be invested best in equipment. Some working agreement is certain to be made between the producers of the raw material in Lorraine and the steel makers in the Ruhr. In addition to being one of the world's most favored centers for steel manufacture, the Ruhr will have an additional advantage, for a time, in that the standard of living has been reduced greatly and low rates of wage will be acceptable. The living standard will increase gradually, but the steel makers will continue to enjoy an advantage until this differential in their favor is overcome.

Our industry is preparing to meet this situation by installing more labor-saving machinery. An indication that our manufacturers have on their fighting clothing is seen in their recent success in securing an order for 35,000 tons of corrugated iron in Argentina, an order for which the Continental industry was striving.

British Situation

On the other hand the British steel makers are in a bad way. Few of their plants are modern. Instead of striving to reduce their costs, effort appears to be concentrated on yelling at the Government. Both labor and capital in Great Britain seems to have fallen into a psychological rut that is hampering them in meeting the increasing difficulties which they are facing. Such a large proportion of the British trade is with other countries that it is certain to be hard hit by the rehabilitation of Germany. A much smaller proportion of our trade is export. In addition, we are in a frame of mind which will do much toward enabling us to hold our own in the export market.

An indication of the commercial demoralization which has overtaken the British, is had in the fact that an American coal company apparently is in a position to compete successfully with Great Britain for a large block of Italy's requirements.

Our technical industries are entrenching themselves at home by a great expansion in the practice of mass production of standardized goods, which because of their low price are finding increasing markets abroad; a stronger position than that occupied by the German industry, which in catering principally to the foreign trade cannot take advantage of the economies of quantity production, but must meet the diverse requirements of many lands. There is every reason, however, for our manufacturers to start at once to increase their selling efforts abroad.

The prevailing standard of living among Germans may be judged from the fact that breadstuffs comprise 60 per cent of their annual diet. Breadstuffs constitute only 20 per cent of the food consumed by the American people. The proportion of animal products and fruit is rising rapidly. The increasing standard of living here is shown strikingly by the fact that sugar consumption has risen to 11 lb. per capita, or just twice the per capita consumption of flour.

Russia Is Buying

Russia at this time is making substantial purchases here of cotton, machine tools and certain other commodities. No confidence can be placed in the future of Russian trade. The establishment of buying commissions in foreign countries, including the United States, tends to bear out every pessimism which has been expressed in connection with the commercial policies of the Soviet authorities. Absolute control of purchasing centers in Moscow. Purchases are shifted quickly for political reasons. The German police, for instance, raided one of the Russian offices and in retaliation, all the buying being done in that country was discontinued and transferred to other countries. Similar action was taken when the Russian authorities were displeased by developments in Italy and Switzerland. This is a new phenomena. No permanent commerce could be built up under such conditions. An official in Washington might make a nasty remark about the conduct of affairs in Moscow and our manufacturers would find the business they had built up transferred, over night, to some other country. Russia is buying in this country, at this time, partially to cater to us and partially because prices are lower. Once that recognition has been secured much of this business would be placed elsewhere to aid in gaining some further objective. The Russian agents, however, are preaching as they buy. They say much larger orders would be placed were Russia recognized. This argument is being pressed in connection with their purchases of cotton and our cotton trade is taking the bait. Sight is lost of the fact that with any return approximating normal, Russia again will become an exporter of cotton.

Production Meeting Plans Perfected

Good progress is being made in the procurement of papers for the Production Meeting of the Society of Automotive Engineers that is to be held in Detroit, Oct. 22 to 24. To assure the selection of topics holding current interest for the papers and the discussions, some 20 representative production executives have assisted the meetings committee by submitting valuable suggestions based on the problems they are actually encountering in motor vehicle factories. Papers have been secured on the subjects of automobile glass manufacture and salvage, checking of wood in paint drying ovens, co-operative labor plans, the group bonus wage incentive plan, tool design, tool maintenance, coining press operations, reduction of waste, methods of shipping finished cars, and reducing the cost of plant maintenance. Solicitation of other papers is being continued. The meetings committee encourages the immediate submission of volunteer contributions by members desiring places on the program.

Definite decision has been reached by the parent society and the Detroit section that an exhibition of production machines and equipment will not be staged co-incidently with the 1924 production meeting.

Drop Forged Wrenches Simplification

As a result of a conference of manufacturers of drop forged wrenches in New York recently, it was the concensus of opinion that reductions in the sizes, models and varieties could be made of the existing 600 or more, and the co-operation of the Division of Simplified Practice, Department of Commerce, has been asked in securing surveys of production and sales, in order that the facts may be at hand in considering tentative recommendations regarding reduction of such varieties. The Division, it was announced, will undertake the necessary surveys in the near future.

Building Locomotives at Bilbao

For the past two years the Bilbao shipyards have been devoting a considerable portion of their plant capacity to the construction and repair of railway rolling stock, Consul H. M. Wolcott, Bilbao, reports to the Department of Commerce. Since the Babcock & Wilcox Co., also in Bilbao, constructs locomotives exclusively, with the exception of boiler tubes, this industry is assuming considerable importance in the district. At present the local plants have contracts for the construction of 25 steam and six electric locomotives as well as a considerable number of tenders, coaches, and freight cars.

General Motors Standards Books at Cost

An announcement has been made by the General Motors Corp. that the valuable standards books published by the corporation are available in quantities at a price that just covers the cost of production. Technical societies and professional men will be supplied with individual copies gratis as in the past. The books are now so comprehensive that they represent quite an expense. To take care of the requests for large numbers of them from big organizations the present plan of supplying them at cost has been adopted.

The Business Barometer

This week's outlook in Commerce, Finance, Agriculture and Industry based on current developments

By Theodore H. Price
Editor, *Commerce and Finance*, New York

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LAST week May wheat sold at over $1.50, rye went above $1.30 and cotton advanced more than a cent a pound. Because it is assumed that these gains will allay the agricultural discontent upon which political radicalism thrives the fear of an indeterminate election is less acute than it was a week ago. But complete confidence in the success of conservatism is not entirely re-established and the hand-to-mouth policy that has become almost national is likely to persist at least until after Nov. 4.

Meantime money continues easy. The new bond issues brought out from day to day seem to be readily disposed of and there is no distension in the stock market except in the radio and public utility issues. As to these two groups a word of caution may be in order.

There are fourteen "radio stocks" quoted on the New York Curb. When the recently held "Radio World's Fair" opened they were selling at an aggregate valuation of $28,000,000. Within three days after the opening of the fair they had appreciated by over $1,000,000. This is an average of barely 4 per cent, but it is just as well to remember that there are good radio stocks and others not so good.

Among the public utility shares there are some that have advanced even more sensationally than any of the radio stocks, for "super-power" has been a word to conjure with. There is no doubt that the earning power of many public utility companies has been greatly increased by the advance in electrical science, but here again discrimination is suggested for "trees never grow to the skies," and even the best electrical fuses blow out sometimes.

The number of securities dealt in outside the New York Stock Exchange is so large nowadays that the aggregate of the business done on the "Curb," "over the counter" and by telephone probably exceeds the turnover recorded on the Stock Exchange.

Except for the advances in wheat, rye and cotton the commodity markets have been relatively quiet. The export demand is the reason assigned for the rather sensational jump in grain, and cotton reflects the tendency toward a reduction in crop estimates.

This tendency may or may not be accentuated by the next government report. No one knows, but the market for cotton goods is restrained by the uncertainty and buyers have refused to pay the advances made necessary by the rise in the raw material. But the export demand for cotton is large and if the crop turns out much under 12½ million bales the supply left in this country next spring may be inadequate.

What's Doing in Industry

Business improved slightly again last week in the machinery and machine tool industry and once more it was due to railroad and general industrial buying. If the automobile manufacturers were buying at a normal rate business would be appreciably better, but perhaps a more even business will result if their purchases are made after the railroads are through. The month of October has started well for the machine tool builders and bids fair to exceed July, August or the first part of September. As compared with a year ago, most producers seem to think that business is as good or perhaps a trifle better, but the difference, if any, is slight.

Pig iron production took a slight drop last week, but steel maintained the output set earlier in the fall. While this output is fair and will probably improve gradually, it is not up to previous comparative periods. Locomotive builders and freight car manufacturers are busy due to a rush of orders received during September and the first week of this month. They will keep busy for the next four months at least.

General business is slightly improved with the coming of autumn and this, too, will improve once the National election is out of the way.

Wall Street experienced another one of those irregular weeks that have occurred with more frequency recently. The volume of business has dropped off slightly and the prices are down a point or two on nearly all barometric issues. Some of the more speculative stocks are down as much as five and six points.

Some large equipment orders emanating from the railroads promise to keep the steel mills fairly busy during the winter, but capacity production before the spring is no longer hoped for. Copper is a shade higher, but the hope of a real advance is again deferred. Tin continues to be the football of the London speculators. One day it is up; the next it is lower. Rubber is higher. There appears to be a genuine war among the oil companies and gasoline is down to 15 cents in New York.

Less activity in building continues to be reported. At the Convention of the American Bankers Association in Chicago, Frank J. Parsons of the United States Mortgage & Trust Co. of New York made an address in which he stated that "the majority of economists hold to the view that building costs and rentals are on the downward grade, that the shortage of structures has been largely overcome and that in the future there will eventually be a surplus of buildings, vacancies, a lowering of rents and decreased earnings."

Concurrently the director of the New York City Bureau of Industrial Aid reports that there are some 300,000 men and women out of work in New York at present and that about 60 per cent of the unemployed are union members. This may explain the acceptance of the reduced wage scale by the operatives in the New England textile mills that are re-opening. But there still is much unemployment in New England and a winter of discontent appears to be in prospect.

The news from Europe is in the main encouraging, but the German loan has not yet been finally arranged and its issuance before election seems very doubtful. Some surprise was created when a reputable bond dealer of Austin, Texas, announced that he would accept subscriptions to a Mexican loan of $50,000,000 secured by the revenue from the oil production tax. The success of the offering would put Mexico on "Easy Street" financially, at least for a time.

Silver has advanced to 70¼ cents on the continued demand from China. Gold imports into the United States seem to have ceased and in a message to the American Mining Congress at Sacramento, President Coolidge predicted that "as soon as the gold standard is again in general operation our stocks will be drawn upon to meet the needs of other countries."

This is almost axiomatic, but it is doubtful whether its implications are fully understood. Eventually, if not now, they will include higher interest rates and the end of gold inflation in the United States.

The Industrial Review

Progress of the machinery and machine-tool business in various parts of the country

THE following reports, gathered from the various machinery and machine tool centers of the country, indicate the trend of business in these industries and what mey be expected from the future:

New York

Buying by the railroads and the railroad car manufacturers were the two features of the New York market during the past week. The volume of business done during the week was fairly satisfactory and better than it has been for some time. Since the middle of September there has been a gradual improvement with further betterment anticipated as the remaining months of the year unfold.

The Southern R.R. was the principal buyer during the week with purchases of punches, shears, drill presses, angle bending roll, and steam hammers recorded. The Lackawanna was another road that made sizeable purchases and dealers say that there are still more to be made by this company which is in excellent financial shape. The Erie also bought a few tools and inquiries have been received from the New Haven, the New York Central and the C. & O.

Locomotive and car builders are expected to send out lists this week and dealers in New York are anxiously waiting for them. The big electric companies were not in the market during the week except for a few necessities. Automobile builders have bought nothing of importance for nearly a month and this source, too, is expected in the market before long.

Dealers in used tools report a brisk business during the week. Purchasing which had been a trifle off, came back again with the beginning of October.

Export business has been good during the week and exporters state that there is no reason why this business should not keep up until cold weather sets in.

Canada

A spirit of optimism in the metal-working industry in Canada is being backed up by encouraging reports. The rolling mills of the Canadian Car & Foundry Co., Ltd., at Amherst, Nova Scotia, are busily engaged on an order for several hundred tons of reinforcing rods to be used for construction work at Montreal. It is the first time that work of this description has been carried out at the Amherst mills. George D. McKinnon, of the McKinnon Steel Co., Sherbrooke, Quebec, reports that his mills are now operating at capacity.

Reports from Montreal are to the effect that some of the major plants have sufficient business to occupy them for at least a year. Some of the smaller firms with few orders on hand are refusing, for the most part, to break up their organizations. This action would indicate that better business is expected in the near future. The tonnage of steel released for delivery during the last two weeks and the amount involved in inquiries was distinctly larger than during the preceding two weeks. The brightest feature in the Toronto market is the activity in copper and brass sales. Pig iron has been quite. Warehouse business in iron and steel is good, and boiler tubes still lead in sales. A slight slump has taken place in the scrap market. In tool steel buying conditions are favorable, but actual sales are small and scattered.

Canada has just concluded a trade agreement with Australia and, while no announcement has yet been made with respect to the items which will secure favorable tariff treatment in each country, it is understood that farm implements and automobiles will figure in the list of Canadian products to enjoy the lower rates of entry to Australia. Commenting on the new agreement, Wallace R. Campbell, vice-president and treasurer of the Ford Motor Co. of Canada, stated that 40 per cent of Canada's total exports to Australia during 1923 went from the Ford plant.

Indianapolis

Business in machine tools and metal working machinery continues to expand, though the rate of expansion is not so great as it was a couple of weeks ago. However, the general situation is so much more improved over the situation of last summer and the same period of a year ago that little complaint is heard. Men prominent in the industry here feel that business will be steady during the remainder of the present year and that the next year will see a real trade revival.

The flour milling machinery business also is picking up, officials of Nordyke-Marmon Co. report. During the summer this business slumped off, but Northwestern mills now are in the market and there has been some call for machinery from middle Western plants. The automobile business seems to have hit its stride and most factories are working steadily, if not at capacity. Tool sales with these plants are much larger than they were some weeks ago.

Detroit

Little change in the machine tool and machinery industry in Detroit has been noted during the past week.

Sales remain somewhat spotty, with a fair proportion of inquiries resulting in actual orders. The outlook for the remaining months of this year is none too bright, as most of the manufacturers in this section are confining themselves to replacements of old machinery and such improved machines as are necessary to meet competitors.

A wide variance in business conditions is reported in some quarters of the machine tool field. Some of the representatives in Detroit have assurances of future business of a very material scale, while others find the way a little rougher.

In the estimation of most dealers 1924 will not show any further wealth of business, but next year should result in a normal amount.

Many of the motor plants are working on an increased production basis and the employment figures are slowly, yet steadily rising. Several companies, including the Hudson-Essex and the Maxwell-Chrysler, are ahead of last year's record, while many others are holding their own.

Southern District

A spell of very bad weather that has prevailed generally over the South since mid September has affected conditions in the machinery and machine tool field in the district to quite an extent, with the result that while sales do not appear to have experienced any marked changes as compared with last year at this time, they have none the less fallen somewhat below the expectations of the dealers. The volume of business, for instance, during the last half of September, declined somewhat as compared with the first half of the month, instead of increasing as the dealers had confidently predicted it would. The rain was almost incessant since Sept. 13, a change for the better resulting on Sept. 30, and better conditions now appearing in prospect for the remainder of the year.

The reason that weather has a more serious affect on conditions in the South than elsewhere is due to the fact that cotton is the most important crop, and that business fluctuates as does cotton. The heavy rainfall has materially lessened the total crop, and most lines of business have sagged as a result. Cotton prices, however, have increased in proportion, so that the future promise for the machine tool industries in the South is equally as bright for the rest of this year as it was a month ago, when a very large cotton crop was in prospect.

The railroads are still buying on nearly the same basis, though there is a sign of lessening inquiries, which will likely result in this business falling off a little during the next month. However, there is every promise at present that railroad equipment sales will be much better than usual in the South during the fall and early winter months this year, as there is considerable shop and terminal construction in progress that will carry well into the winter months.

Textile business, after experiencing

some improvement in the early part of September, has held to about the same basis, better than in several months, but still spotty and, as a whole, slack. The future is more or less uncertain, though dealers are confident there will be good business in this field after the first of the year.

Road building equipment sales also have declined appreciably, and though some work continues in progress, there will be but little activity in this field again before early in 1925, when the trade is looking for another prosperous season.

Other principal buyers include the service stations, smaller shops and lumber mills, with a majority of sales of used and rebuilt equipment.

Buffalo

Scattered orders for individual machines continue to prevail in Buffalo, but there seems to be enough business of this sort to keep the machinery dealers optimistic. Lathes, drill presses, shapers and milling machines are the principal items for which there is any considerable demand but no dealers interviewed reported any great volume.

One firm selling contractor's equipment reported that most of the demand for building and road construction work had been supplied for the present season. In this line the principal items in demand right now are concrete mixers and hoists. A few cranes, of the smaller sizes, are being sold.

Reports from a firm that has offices in Syracuse and Rochester indicate that business in those two cities is about on a par with business in the Buffalo territory, not so heavy as might be wished, but, nevertheless, keeping fairly close to last year's records and occasionally ahead of it on the month by month comparison.

There are practically no large lists out at the present time and the general feeling is that few large orders of machinery will be placed before the latter part of November.

Milwaukee

So far there has been no striking increase in the number of items of metalworking equipment sold by local manufacturers or dealers over the average of recent months, but unmistakable signs of improvement in the business situation are making their appearance. Business of the metal trades is better than it was all summer, and this is having a healthy effect upon the sale of shop tools and other equipment. Inquiry, meanwhile, has become more active, and while by no means brisk, is far in excess of that noticeable in the earlier months of the year.

Although the manufacturers of machinery for paper mills are reported as doing a much better business than for several months past, this source of machine tool business has not made the same headway as firms in other lines experiencing similar improvement. This leads to the belief, or at least the hope, that better orders may soon be expected. Lumber manufacturing continues to absorb a fair quantity of equipment, with furniture makers in the lead as to the heaviest buyers.

Naturally, the automobile industry is again an important tool market factor, as it has hit a stride that is comparable to the first months of 1924 as respects production and the retail market. But it seems to be a fact that in most instances, automobile shops are not pressed to buy much additional machinery, for whenever output is kept close to the marketability point, present facilities suffice, making it a matter of replacement demand.

It would seem that the Nash interests are not following the ordinary procedure of large machinery buyers in equipping the old Mitchell automobile works at Racine for the purposes of the new Ajax Motors Co. This may be due to the fact that the bulk of the standard types of machines the operation will require are met by the acquisition of the equipment of the liquidated Lafayette Motors Corp. at Milwaukee. On the other hand, the Ajax project is moving cautiously, and the bulk of the needs are still in the foreground, so that makers and dealers as well still have to look forward to some large requirements. Some buying of special machinery is being done right along, but it is difficult to identify the source because of the ramifications of the Nash industries and the care exercised in making selections and placing orders.

The A. O. Smith Corporation, Milwaukee, automobile frames and forgings, and the Briggs & Stratton Co., automobile accessories, are in the market for some equipment.

Personals

HARRY MINER, European representative for the Landis Tool Co., the Kearney & Trecker Corp., and Warner & Swasey, returned to the United States on the S. S. George Washington, Sept. 28.

C. I. OCHS, vice-president and general manager of the axle division of the Eaton Axle & Spring Co., Cleveland, has been appointed general manager of the entire company, embodying the bumper, spring, and axle divisions. Plants of these divisions are at Cleveland, Albany, N. Y., and Pontiac, Mich.

J. WILLIAM JONES, formerly designing engineer with the Ingersoll-Rand Co., plant at Painted Post, N. Y., has resigned to become assistant chief designing engineer of the Buick Automobile Co., Flint, Mich.

S. P. SCHAFER is the factory representative for the Eastern district for the Racine Tool & Machine Co., Racine, Wis.

EVAN F. JONES, formerly with the Wickwire-Spencer Steel Co., Worcester, Mass., has been made general manager of the Atlas Die Casting Co., Worcester.

W. B. MCSKIMMON, vice-president of the Union Twist Drill Co., Athol, Mass., returned to the United States on the S. S. Samaria, Sept. 29, after a business trip to Europe.

B. J. FLANAGAN, treasurer of the Herberts Machinery & Supply Co., Los Angeles and San Francisco, has resigned.

GILBERT J. MACQUARRIE, for many years connected with the Crucible Steel Co., of America, has been appointed manager of the Boston office of William Jessop & Sons, Inc., New York.

CLARE OSBORN, who recently formed the firm of Clare Osborn, Ltd., with offices as construction machinery specialists in Toronto and Niagara Falls, has been appointed as agent for Ontario for the Erie Steam Shovel Co.

C. A. BIEBER has been appointed general manager of the Eaton Axle & Spring Service Co., having general charge of the factory branches at New York, Chicago, Philadelphia, Boston and Cleveland, as well as the jobbing department of the Eaton Axle & Spring Co.

T. A. RUSSELL, head of the Willys-Overland Co., Ltd., has been elected president of the Automotive Industries' Association of Canada, and C. A. CARLISLE, general manager of the Goodyear Tire and Rubber Co. of Canada has been elected vice-president of the association.

ROY H. HOFFERT, general superintendent of the Christensen Machine Co., a subsidiary of the F. J. Greene Engineering Works, Racine, Wis., sailed Oct. 4 from New York for Europe to investigate business possibilities and to introduce a new line of equipment for printing and publishing plants, including press feeders, book binders, folders, stitchers, etc.

I. J. REUTER, general manager of the Remy Division of the General Motors Corp., Detroit, has been made president of the Klaxon Co., the sales organization.

FREDERICK L. WOOD, formerly factory superintendent at the Connecticut Telephone & Electric Co., Meriden, Conn., has accepted the position of production superintendent at the plant of Foster, Merriam & Co., Meriden.

G. H. BERNARD and C. S. POLAND have joined the sales organization of the Remy Electric Co., Detroit. Mr. Bernard will have supervision over the sale of motor bus equipment, while Mr. Poland will replace R. H. SMITH, recently transferred to the Detroit sales office.

J. J. WILSON has severed his active connection with the foundry of Hiram Walker Metal Products, Ltd., Walkerville, Ontario, but is retained in an advisory capacity. Mr. Wilson is well known through his connection with the American Foundrymen's Association.

J. W. COONEY, of Irvine, Pa., will move to Anderson, Ind., and be the new manager of the Anderson Foundry & Machine Co., which will be known as the Anderson Oil Engine Co.

CHARLES E. MOORE, secretary of the Herberts Machinery & Supply Co., is now in charge of the San Francisco, Calif., office.

CLARENCE AVILDSEN, president of the Valley Forge Steel & Tool Co., Chicago, returned to the United States on the S. S. Laconia after visiting important iron and steel centers in England and the Continent.

JOHN HAYDOCK has resigned as assistant superintendent of the Pond Works of the Niles-Bement-Pond Co. to take a position as maintenance engineer with the National Aniline & Chemical Co., Buffalo.

C. A. SNYDER, formerly sales manager for the Stutz Motor Car Co., Indianapolis, has joined the organization of the Chrysler Motor Car Co., Detroit.

A. H. DREHER, formerly advertising manager of the Chandler Motor Car Co., Cleveland, has joined the organization of the Peerless Motor Car Co., Cleveland.

HARRY M. ROBINS, formerly director of foreign sales for Dodge Bros., has been appointed director of districts of the Oakland Motor Car Co.

Business Items

The Bilton Machine Tool Co., of Bridgeport, Conn., has re-organized and changed its financial structure. The company's capitalization remains $1,000,000, but the shares are changed to 8,000 shares of no par common and 2,000 shares preferred $100 par. Formerly there were 6,000 shares of common and 4,000 shares preferred both $100 par.

The E. W. Bliss Co. has closed its Buffalo office, and R. W. Orr, former manager, has been transferred to the Pittsburgh district. The Buffalo territory is to be handled through the Rochester office of the E. W. Bliss Co.

The Longtine Valve Co., capitalized at $100,000, has been incorporated in San Francisco. The directors are: R. V. Longtine, Max Shapero, W. E. Finney, W. C. De Haas and C. A. De Haas.

The B. & B. Manufacturing Co., Racine, Wis., has been organized by C. S. Bonin and Ernest Bruce for the purpose of acquiring the plant and machinery of the Sieverkropp Engine Co., Racine, and engaging in the manufacture of tools, dies, jigs, fixtures, etc.

The Doehler Die-Casting Co., Brooklyn, has purchased the plant of the Batavia Rubber Co., Batavia, N. Y., and will move to that city within the near future. The new plant adjoined a foundry that the Doehler company has had in Batavia for some time.

Redemption of $25,000 worth of Rockford Milling Machine Co. first mortgage bonds will take place Nov. 1 at the office of the Northern Trust Co., Chicago, Ill.

Controlling interest in the Diesel Gas Engine Works of Cologne, Germany, has been acquired by the Superior Gas Engine Co., of Springfield, Ohio.

A building formerly occupied by manufacturers of toys in Alliston, Ontario, has been sold to the Ontario Machinery and Supply Co., of Toronto.

The White Manufacturing Co. has moved into its new factory at Elkhart, Ind. The company was formerly located at Goshen, Ind.

The Chausse Oil Burner Co. has moved into its new factory at Elkhart, Ind. The plant formerly occupied by the company was destroyed by fire.

All the property of the Anderson Foundry & Machine Co., Anderson, Ind., a subsidiary of the R. L. Dollings Co. of Indiana, which has been in the hands of W. T. Durbin, as receiver, for more than a year, will be turned over to a new corporation composed of the creditors and stockholders of the Anderson company, under an order issued in the Madison circuit court Oct. 1.

Federal incorporation has been granted in Canada to the Concord Steel Corp., Ltd., with a capitalization of $525,000, and with the privilege of carrying on the business of manufacturers of boilers, engines, radiators motors, etc. Headquarters will be in Montreal.

The New York service station of the Wagner Electric Corp., St. Louis, Mo., has been moved to 321 West 54th St.

The Enterprise Engine Co., San Francisco, Calif., and the Western Machinery Co., Los Angeles, Calif., have been merged into one company with headquarters in Los Angeles.

Obituaries

WELLINGTON P. KIDDER, aged 72 years, consulting engineer of the Rochester Industries, Inc., Rochester, N. Y., died recently at the Hotel Belmont, New York City. Mr. Kidder was well known as an inventor, having contributed to the improvement of the typewriter, the printing press and the steam engine. He was a member of the American Society of Mechanical Engineers.

STEPHEN MOLTRUP, secretary and treasurer of the Moltrup Steel Products Co., Beaver Falls, Pa., died recently in that city.

WILLIAM H. DEMING, aged 81 years, died at his home in Waterbury, Conn., recently. Mr. Deming had been mechanical engineer for the Continental Iron Works of Brooklyn, N. Y., for fifty-four years.

Railroads Report Good August Business

Net operating income of the Class One railroads for August was $95,415,300 compared with $98,934,000 in August of last year, according to figures just made public by the Bureau of Railway Economics. This is at the rate of 4.69 per cent on tentative valuation. The favorable showing for August was accounted for by the economies that the managers put into effect on their respective railroads.

The gross income for the month was $508,394,000, or $56,134,600 less than in the corresponding month of last year. Operating expenses totaled $373,599,300, a decrease of $52,853,900 in comparison with the same month of last year.

For the first eight months of the year the total net operating income of the Class 1 railroads was $561,059,355, compared with $630,715,546 for the same period of last year. In other words the net revenues showed a decrease of but 8 per cent, while the freight traffic for the first eight months was 12 per cent under the corresponding period of last year.

Thirteen Class 1 railroads operated at a loss during August, including six in the Eastern, two in the Southern and five in the Western districts. In July there were twenty-seven roads which had operating deficits.

The August decrease in operating expenses compared with August, 1923, was accounted for by a reduction of $142,109,300, or more than 9 per cent in maintenance. For August alone the railroads reported a saving of $33,924,600 in maintenance expenses.

Carriers in the Eastern district had a net operating income in August of $46,500,800, compared with $51,914,190 in August of last year; the carriers of the Southern district had a net operating income of $10,947,350 compared with $8,953,000 in August of last year, and the carriers in the Western district reported a net operating income of $37,967,150, against $38,066,800 for the same month of last year.

Forthcoming Meetings

Motor and Accessory Manufacturers' Association. Annual meeting, Cleveland, Ohio. Week of Oct. 6, 1924.

American Foundrymen's Association. Twenty-eighth annual convention. Milwaukee, Wis. Week of Oct. 13, 1924.

National Industrial Advertisers Association. Annual meeting, Edgewater Beach Hotel, Chicago, beginning Oct. 13, 1924.

Management Week. Under the auspices of the American Society of Mechanical Engineers. Week of Oct. 20, 1924. Simultaneously held in leading cities.

American Gear Manufacturers Association. Semi-annual fall meeting. Briarcliff Lodge, Briarcliff Manor, N. Y., Oct. 16, 17 and 18. T. W. Owen, secretary, 2443 Prospect Ave., Cleveland, Ohio.

Society of Automotive Engineers. Production meeting. General Motors Building, Detroit, Mich., Oct. 22, 23 and 24. C. S. Clarkson, secretary.

American Welding Society. Annual Convention, Cleveland, Oct. 30 and 31. Miss M. M. Kelly, 29 W. 39th St., New York City.

American Society of Mechanical Engineers. Forty-fifth annual meeting. New York City. Dec. 1 to 4. Calvin Rice, secretary, 29 West 39th St., New York City.

National Exposition of Power and Mechanical Engineering. Grand Central Palace, New York City, Dec. 1 to 4. Charles F. Roth, 1102 Grand Central Palace Building, New York City.

Exposition of Invention. Engineering Societies Building, 29 West 39th St., New York City. Dec. 8 to 13 inc., General offices, 47 West 34th St., New York City.

American Association for the Advancement of Science. Meeting at Washington, D. C., Dec. 29, Jan. 1, 2 and 3. Burton Livingston, Smithsonian Institute, Washington, D. C.

Society of Automotive Engineers. Annual Meeting. Detroit, Mich., Jan. 20, 21, 22 and 23. C. F. Clarkson, 29 W. 39th St., New York City.

The Weekly Price Guide

Rise and Fall of the Market

Iron and Steel—Pig iron demand confined to small lots. Price of No. 2 f'dry, Southern, firm at $18 per ton, Birmingham. Surplus iron stocks dwindling. Weakness continues in most steel items. Some firmness, however, has developed in shop supplies such as bolts, screws, etc. Demand for car material, plates and sheets is active. Steel bars are $2 per 100 lb.; plates, $1.60@$1.90 and shapes, $1.90@$2, Pittsburgh; these are practically at the same minimum prices as a week ago.

Non-Ferrous Metals—Nickel ingots up 2c. and electrolytic 3c. per lb., f.o.b. refinery. Electrolytic copper slightly weaker; price down ¼c. per lb. since Sept. 25. Tin quotations higher in foreign markets; price rose 1¼c. per lb. in New York warehouses. Lead, zinc and antimony firmer; prices unchanged in week.

(All prices as of Oct. 3)

IRON AND STEEL

PIG IRON—Per gross ton f.o.b.:

CINCINNATI	
No. 2 Southern	$21.55
Northern Basic	21.27
Southern Ohio No. 2	21.77
NEW YORK—Tidewater Delivery	
Southern No. 2 (silicon 2.25@2.75)	25.10
BIRMINGHAM	
No. 2 Foundry	18.00
PHILADELPHIA	
Eastern Pa., No. 2x (silicon 2.25@2.75)	22.34
Virginia No. 2	29.75
Basic	21.25
Grey Forge	21.25
CHICAGO	
No. 2 Foundry local	20.50
No. 2 Foundry, Southern (silicon 2.25@2.75)	24.50
PITTSBURGH, including freight charge from Valley	
No. 2 Foundry	22.77
Basic	22.77
Bessemer	23.77

IRON MACHINERY CASTINGS—Cost in cents per lb. of 100 flywheels, 6-in. face x 24-in. dia., hub not cored, good quality gray iron, weight 275 lb.:

Detroit	4.75
Cleveland	4.75@5.00
Cincinnati	5.00@7.50
New York	5.00@5.50
Chicago	5.25@5.75

SHEETS—Quotations are in cents per pound in various cities from warehouse; also the mill base in large lots.

Blue Annealed	Pittsburgh Mill Base	New York	Cleveland	Chicago
No. 10	2.60@2.70	3.89	3.45	3.80
No. 12	2.70@2.80	3.94	3.50	3.95
No. 14	2.80@2.90	3.99	3.55	4.00
No. 16	3.00@3.10	4.09	3.65	4.10
Black				
Nos. 17 and 21	3.25@3.35	4.40	4.15	4.55
Nos. 22 and 24	3.30@3.40	4.45	4.20	4.55
Nos. 25 and 26	3.35@3.45	4.50	4.25	4.60
No. 28	3.40@3.50	4.60	4.35	4.50
Galvanized				
Nos. 10 and 11	3.50@3.60	4.60	....	4.60
Nos. 12 and 14	3.60@3.70	4.70	....	4.70
Nos. 17 and 21	3.90@4.00	5.00	....	5.00
Nos. 22 and 24	4.05@4.15	5.15	3.00	5.15
No. 26	4.20@4.30	5.30	4.15	5.30
No. 28	4.50@4.60	5.60	5.45	5.50

WROUGHT PIPE (Welded)—Warehouse discounts are as follows:

	New York Black	New York Galv.	Cleveland Black	Cleveland Galv.	Chicago Black	Chicago Galv.
1 to 3 in. steel butt welded	48%	34%	55½%	43½%	56%	43%
2½ to 6 in. steel lap welded	44%	30%	53½%	40½%	53%	40%

Malleable fittings: Classes B and C, banded, from New York stock sell at list plus 4%; class A, plus 23%. Cast iron, standard sizes, 36% off.

SEAMLESS STEEL TUBING—Following base discounts are on 20 gauge or .035-in., round, cold-drawn tubing, ⅛-in. to 1-in., O.D., weighing 0.17 lb. to 0.36 lb. per ft. Cutting charge per 100 cuts, $1.50 to $1.58:

O.D. Inches	List Price per ft.	Differential Discount	O.D. Inches	List Price per ft.	Differential Discount
⅛	$0.09	50%	⅞	$0.16	35%
¼	.11	45%	1	.18	31%
⅜	.14	40%			

NOTE—The discounts are to be lowered by the following differentials in the case of regular .10-.20 carbon: 25,000 ft. or over, 83; 15,000 to 25,000 ft., 82; 5,000 to 15,000 ft., 81; 1,000 to 5,000 ft., 80; less than 1,000 ft., 79.

MISCELLANEOUS—Warehouse prices in cents per pound in 100-lb. lots:

	New York	Cleveland	Chicago
Open hearth spring steel (base)	4.50	6.00	4.20
Spring steel (light) (base)	7.00	6.00	6.00
Coppered Bessemer rods (base)	6.85	8.00	6.55
Hoop steel	4.49	4.35	4.15
Cold rolled strip steel	7.00	8.25	7.15
Floor plates	5.55	4.60	5.50
Cold drawn shafting or screw	4.05	3.90	3.80
Cold drawn flats, squares	4.55	4.40	4.30
Structural shapes (base)	3.34	3.20	3.10
Soft steel bars (base)	3.24	3.10	3.00
Soft steel bar shapes (base)	3.24	3.11	3.00
Soft steel bands (base)	3.99	3.20	3.65
Tank plates (base)	3.34	3.42½	3.10
Bar iron (2.90@3.00 at mill)	3.24	3.21	3.00
Tool steel	11.00	....	....
Drill rod (from list)	60%	55%	50%

Electric welding wire, New York, 3/32, 8.35c.; ⅛, 7.85c.; 5/32 to ½, 7.35c. per lb.

METALS

Current Prices in Cents Per Pound

Copper, electrolytic (up to carlots), New York			13.50
Tin, 5-ton lots, New York			49.75
Lead (up to carlots), St. Louis	7.80	New York	8.50
Zinc (up to carlots), St. Louis	6.17	New York	7.00

	New York	Cleveland	Chicago
Aluminum, 98 to 99% ingots, 1-15 ton lots	27.10	28.00	28.50
Antimony (Chinese), ton spot	12.00	13.25	10.00
Copper sheets, base	20.12½	20.12½@20.62½	23.00
Copper wire, base	18.12½	18.50	21.75
Copper bars, base	19.37½	20.37½	22.50
Copper tubing, base	22.25	23.25	25.75
Brass sheets, base	16.87½	16.87½	19.75
Brass tubing, base	21.00	22.00	28.25
Brass rods, base	14.62½	15.62½	17.50
Brass wire, base	17.37	18.75	20.25
Zinc sheets (casks)	10.60½	11.10	....
Solder (½ and ½), (case lots)	37@38	32.50	30.00
Babbitt metal (83% tin)	60.00	58.00	48@52
Babbitt metal (35% tin)	28.00	18.50	23@26
Nickel (ingot and shot) f.o.b. refinery	29.00	....	....
Nickel (electrolytic) f.o.b. refinery	33.00	....	35.00
Nickel (F shot) f.o.b. refinery	30.00	....	....

SPECIAL NICKEL AND ALLOYS—Price in cents per lb., f.o.b. Huntington, W. Va.:

Rolled nickel sheet (base)	52.00
Hot rolled rods, Grade "A" (base)	50.00
Cold drawn rods, Grade "A" (base)	58.00

Shop Materials and Supplies

METALS—Continued

Manganese nickel hot rolled rods "E"—low manganese (base) 54.00
Manganese nickel hot rolled rods "D"—high manganese (base) 57.00

Base price of monel metal in cents per lb., f.o.b. Huntington, W. Va.:

Shot	32.00	Hot rolled rods (base)	40.00
Blocks	32.00	Cold drawn rods (base)	48.00
Ingots	38.00	Hot rolled sheets (base)	42.00

OLD METALS—Dealers' purchasing prices in cents per pound:

	New York	Cleveland	Chicago
Crucible heavy copper	10.75@11.25	10.25	11 00
Copper, heavy, and wire	10.50@11.00	10.00	10 50
Copper, light, and bottoms	9.25@ 9.50	9 25	9.50
Heavy lead	6.25@ 6.50	6.00	7.00
Tea lead	5.25@ 5.50	4.50	5.50
Brass, heavy, yellow	6.50@ 6.75	6.50	7.00
Brass, heavy, red	8.50@ 8.75	8.00	8.50
Brass, light	5.50@ 5.75	5.50	6.00
No. 1 yellow rod turnings	7.00@ 7.50	7.25	7.00
Zinc	3.75@ 4.00	3.75	3.50

TIN PLATES—American Charcoal—Bright—Per box.

		New York	Cleveland	Chicago
"AAA" Grade:				
IC,	20x28, 112 sheets	$23.50	$22.85	$21.00
"A" Grade:				
IC,	20x28, 112 sheets	19.00	18.80	17.00
	Coke Plates—Primes, 20x28 in.			
100-lb.,	112 sheets	13.00	13.00	12 75
	Terne Plates—Small lots, 8-lb. Coating			
IC,	14x20	7.25	6.80@6.90	6.50@6.75

MISCELLANEOUS

	New York	Cleveland	Chicago
Cotton waste, white, per lb.	$0.14@0.21	$0.19	$0.14
Cotton waste, colored, per lb.	.09@ .14½	.18	.10½
Wiping cloths, 13½x13½, per lb	11.25*	36.00 per M	.16
Wiping cloths, 13½x20½, per lb.	....	50.00 per M	.16
Sal soda, per 100 lb.	2.40	2.25	2.65
Roll sulphur, per 100 lb.	3.60	3.25	3.50
Linseed oil, per gal., 5 bbl. lots	1.03	1.16	1.05
Lard cutting oil, 25% lard, per gal.	.55	.50	.32
Machine lubricant, medium-bodied (50 gal. wooden bbl.), per gal.	.29	.35	.21
Belting—Present discounts from list in fair quantities (½ doz. rolls).			
Leather—List price, 24c. per lin. ft. per inch of width for single ply.			
Medium grade	40–2½%	30–10%	30–10%
Heavy grade	30–5%	30%	20–5–2½%
Rubber transmission:			
First grade	50%	50–10%	40–10%
Second grade	50–10%	60–5%	60–5%
Abrasive materials—In sheets 9x11 in.,			
No. 1 grade, per ream of 480 sheets:			
Flint paper	$4.86	$5.84	$6.48
Emery paper	10.71	11.00	8.80
Emery cloth	28.00	31.12	29.48
Emery disks, 6 in. dia., No. 1 grade, per 100:			
Paper	1.49	1.24	1.40
Cloth	3.38	2.67	3 20
Fire clay, per 100 lb. bag		.65	.60
Coke, prompt furnace, Connellsville	per net ton		3.00@3.25
Coke, prompt foundry, Connellsville	per net ton		4.25@4.75
White lead, dry or in oil	100 lb. kegs	New York, 14.75	
Red lead, dry	100 lb. kegs	New York, 14.75	
Red lead, in oil	100 lb. kegs	New York, 16.25	

*White, at washery.

Comparative Warehouse Prices

New York	Unit	Current Price	Four Weeks Ago	One Year Ago
Soft steel bars	per lb.	$0.0324	$0.0324	$0.0354
Cold finished shafting	per lb.	.0415	.0415	.0465
Brass rods	per lb	.15	.15	.1575
Solder (⅛ and ¼)	per lb.	.37@.38	.385	.295
Cotton waste	per lb.	.14@.21	.14@.21	10@13
Washers, cast iron (½ in.)	per 100 lb.	6.50	6.50	6.50
Emery, disks, cloth, No. 1, 6 in. dia.	per 100	3.38	3.38	3.38
Lard cutting oil	per gal.	.55	.55	.55
Machine oil	per gal.	.29	.29	.297
Belting, leather, medium	off list	40–2½%	40–2½%	30–10%
Machine bolts up to 1x30 in.	off list	50%	50%	40–10%

SHOP SUPPLIES

Current Discounts from Standard Lists

	New York	Cleveland	Chicago
Machine Bolts:			
All sizes up to 1x30 in.	50%	60%	60%
1½ and 1½x3 in. up to 12 in.	15%	.....	....
With cold punched hex. nuts up to 1 in. diam. (plus std. extra of 10%)	40%	$3.50 net	.....
With hot pressed hex. nuts up to 1x30 in. (plus std. extra of 10%)	45%	3.50 net	60%*
Button head bolts, with hex. nuts	10%	3.50 net	.....
Hex. head and hex. nut bolts	10%	.....	.....
Lag screws, coach screws	50%	.....	65%
Square and hex. head cap screws	75%	75–10%	.....
Carriage bolts, up to 1 in. x30 in.	40%	60%	55%
Bolt ends, with hot pressed nuts	50%	.....	60%
Tap bolts, hex. head, list plus	35%	.....	$4.65
Semi-finished nuts, ⅞ and smaller	70%	.....	.....
Semi-finished nuts, ¾ and larger	65%	70%	.....
Case-hardened nuts	50%	.....	.....
Washers, cast iron, ½ in., per 100 lb. (net)	$6.50	$4.00	$3.75
Washers, cast iron, ¾ in., per 100 lb. (net)	5.50	4.00	3.75
Washers, round plate, per 100 lb. Off list	1.50	5.00	4.50
Nuts, hot pressed, sq., per 100 lb. Off list	1.50	4.00	4.00
Nuts, hot pressed, hex., per 100 lb. Off list	1.50	4.00	4.00
Nuts, cold punched, sq., per 100 lb. Off list	1.50	4.00	4.00
Nuts, cold punched, hex., per 100 lb. Off list	1.50	4.00	4.00
Rivets:			
Rivets, ⅞ in. dia. and smaller	50%	60–10%	70%
Rivets, tinned	50%	60–10%	70%
Button heads ¾-in., ⅞-in., 1x2 in. to 5 in., per 100 lb. (net)	$5.00	$3.50	$3.50
Cone heads, ditto (net)	5.20	3.60	3.70
1½ to 2-in. long, all diameters, *EXTRA* per 100 lb.	0.25	.....	0.15
¾ in. diameter *EXTRA*	0.35	.....	0.15
½ in. diameter *EXTRA*	0.75	.....	0.50
1 in. long, and shorter *EXTRA*	0.75	.....	0.50
Longer than 5 in. *EXTRA*	0.50	.....	0.25
Less than 200 lb. *EXTRA*	0.50	.....	0.50
Countersunk heads *EXTRA*	0.45	.....	....

*Square.

Machine Requirements and Industrial Construction

Machine Tools and Equipment Wanted

Calif., Los Angeles—Bd. Pub. Works—5-ton electric traveling crane for garbage loading station.

Calif., Salinas — Salinas Union High School Dist., F. S. Clark, Clk.—one vertical sliding head drilling machine approximately 26 in. swing, power feeds, with and without tapping attachment.

Ill., Arthur—Progress Mfg. Co.—circular shear and flanger.

Ill., Rockford—A. Carlson Mfg. Co., Kishwaukee St. and Blackhawk Ave.—woodworking machinery, including sticker and sander.

Me., Sanford—Sanford Garage Co. — equipment for automobile repair garage.

Mass., Boston — Irving & Casson, 573 Boylston St.—woodworking machinery for furniture factory.

Mass., Boston—Union Realty Co., 100 Cummington St.—equipment for machine shop on Linden St.

Mass., Brockton—M. Goodman, 25 Pleasant St.—equipment for repair garage on Main St.

Mass., Chelsea—Standard Box Mfg. Co., Gerrish Ave.—woodworking machine.

Mass., Tewksbury — The City School Board — equipment for Manuel Training Dept. in Foster School.

Mass., Woburn—C. De Rosa, Salem St.—equipment for machine and repair shop.

Mo., Wentworth — M. P. Gerbing—drill press and metal lathe for machine shop and garage.

N. Y., Hoosick Falls—Lovejoy Chaplet Co., R. Brownell, Purch. Agt.—one high speed automatic screw machine to work brass to ⅜ in. diameter.

N. Y., New York—Modern Wire Frame Co., 412 East 23rd St.—electric spot welding machine 60 cycle, 220 v.

N. Y., Rochester—North East Electric Co.—500 to 800 ton hydraulic forging press.

O., Canton—Timken Roller Bearing Co.—open throat or alligator shear 5 in. square to 2 in. x 24 in. flat.

Pa., Pittsburgh — Fitzsimmons & Cole Machinery Co., 1208 House Bldg.—14-ft. x ¼-in. plate shear and 6-ft. x ½-in. plate shear.

Wis., Green Bay — N. Rosenberg, 319 North Jackson St. — additional machine tools, including lathe, drill press, etc.

Wis., LaCrosse—The LaCrosse Refrigerator Co., J. Samuels, Gen. Mgr.—metal, wood-working and enameling machinery, etc.

Wis., Prairie du Chien—Perfection Mfg. Co., J. Ernie, Pres. — woodworking machinery.

Alta., Edmonton—Sinclair Spruce Lumber Co., Ltd., W. G. Macfarlane, Purch. Agt.—complete equipment for new saw and shingle mills.

N. B., St. John—Nouvelle Lumber Co., Ltd., c/o S. H. Hunton—complete saw mill equipment.

Ont., Alliston — J. Carr—saw frame, edger, etc., for sash and door manufacturing.

Ont., Leamington—Wigle Motor Sales Co.—equipment for $50,000 garage and auto repair plant destroyed by fire.

Ont., Peterboro — Central Machine Shop—thread cutter and drill.

Ont., Peterboro — White & Ackford, George St.—C. A. White, Purch. Agt. — small lathe, grinder and miscellaneous tools for machine repairs, etc.

Ont., Sarnia—Dominion Alloy Steel Corp.—10 ton 45 ft. span electric traveling crane.

Ont., Warkworth — G. Bowen—mortiser and tenoner.

Que., Cap Chat—J. Richardson & Co., Ltd., W. Russell, Purch. Agt.—planing, sawing and bending machines.

Que., Montmagny—Thibault Limited—double edger, planer, etc., for sash and door factory.

Que., Montreal—T. B. Desrochers, 7 Casgrain St.—complete equipment for garage and repair shop.

Que., Montreal—J. Senneville, 441 Desormeaut St.—circular saw and motor.

Que., Montreal—T. Texvais, 559 Maisonneuve St.—complete equipment for garage.

Opportunities for Future Business

Calif., Los Angeles—Miller & Gilbert, 497 Merritt Bldg., plans the construction of a 9 story, 100 x 125 ft. garage at 6th and Carondelet Sts.

Calif., Los Angeles—H. P. Rehbein, 7038½ Hollywood Blvd., is receiving bids for the construction of a 3 and 5 story, 150 x 180 ft. garage and office building at Sycamore and Hollywood Blvd. Estimated cost $300,000 to $500,000. R. D. King, Van Nuys Bldg., Archt.

Calif., Oakland—Laher Auto Spring Co., 167 Hayes St., San Francisco, plans the construction of a factory on Magnolia and 26th Sts. Estimated cost for 1st unit $50,000.

Calif., San Francisco — Diamond Patent Showcase Co., 1625 Mission St., is receiving bids for the construction of a 1 story factory at Folson and 8th Sts. Estimated cost $45,000. J. P. Shaffer, 987 Mission St., Archt.

Mass., Boston—M. B. Davis, 155 Main St., Brockton, is having plans prepared for the construction of a 2 story, 140 x 100 ft. repair and service garage, Spring St. and Acushnet Ave. Cost will exceed $75,000. R. P. Jackson, 86 Main St., Brockton, Archt.

Mass., Boston—Syndicate, c/o Sutherland & Sutherland, 77 Summer St., Archts., plans the construction of a 4 story, about 5,500 ft. per floor garage, Bach Bay district. Estimated cost $160,000.

Mass., Cambridge—J. F. White, 54 Ellery St., plans the construction of a 1 story, 240 x 150 ft. repair and service garage on Mt. Auburn St., corner University Road. Estimated cost $150,000. G. F. Fitzgerald, 418 Broadway, Engr.

Mass., New Bedford — Brockton Public Market, Purchase St., plans the construction of a 2 story, 130 x 105 ft. repair and service garage at Spring and Purchase Sts. Estimated cost $80,000. LaBrode & Bullard, 88 Purchase St., Archt.

Mo., Kansas City—Black, Sivalls & Bryson, Inc., Bartlesville, Okla., manufacturers of wood and steel tanks, awarded the contract for the construction of a 1 story, 180 x 386 and 488 ft. factory at Blue River Industrial Dist. Estimated cost $85,000.

Mo., Kansas City—J. C. Nicholds, Inc. Co., Mayer Blvd. and Ward Parkway, will build a 2 story, 75 x 120 ft. garage. Estimated cost $70,000. Private plans.

Mo., St. Louis—Riefling Auto Co., 2331 South Jefferson St., will build a 2 story, 75 x 120 ft. auto repair shop on South Jefferson Ave. Estimated cost $75,000.

N. J., Newark—Auto Strop Safety Razor Co., 59 Lock St., awarded the contract for the construction of a 3 story manufacturing building. Estimated cost $150,000.

N. J., Trenton Junction (Trenton P.O.)—Guilbert & Betelle, State House, Trenton, Archts. will receive bids until Oct. 28 for additional buildings including a shop building for New Jersey School for the Deaf. Estimated cost $500,000. A. H. Moses, Camden, Engr.

N. Y., Albany—New York Central R.R. Co., awarded the contract for the construction of a 2 story, 217 x 50 ft. upholstery shop at West Albany R.R. yards. Estimated cost $110,000.

N. Y., Long Island City—International Harvester Motor Co., Grand Central Terminal, will soon receive bids for the construction of an assembling plant, at 13th and Hamilton Sts. Estimated cost $250,000. Private plans.

O., Cleveland—The Angell Nail & Chaplet Co., 2657 East 79th St., plans the construction of a factory on East 71st St.

O., Cleveland—Barnes Motor Co., W. P. Barnes, Pres., 1938 East 21st St., awarded the contract for the construction of a 2 story, 100 x 135 ft. auto sales, service and repair shop on Wire Ave. Estimated cost $150,000.

O., Cleveland — Novelty Lamp & Shade Co., G. Klein, Pres., 2490 East 22nd St., will soon award contract for a 4 story, 60 x 60 ft. addition to factory at 2400 East 22nd St. Estimated cost $40,000. A. Sogg, 3030 Euclid Ave., Archt.

O., Cleveland — Sterling Brass Co., S. Weil, Pres., 9600 St. Catherine Ave., plans the construction of a factory and warehouse building on St. Catherine Ave. Estimated cost $50,000.

Wash., Seattle—Inter-Avenue Bldg. Co., c/o H. Thomas, Arcade Bldg., awarded the contract for the construction of a 7 story, 111 x 160 ft. garage building at 1st and Union Sts. Estimated cost $200,000.

Wis., Menomonie—Menomonie Welding & Machine Works, A. B. Keller, Prop., will build a 2 story, 46 x 50 ft. machine shop. Estimated cost $25,000. Private plans.

Wis., Racine—Wisconsin Incubator Co., 18th and Holborn Sts., is receiving bids for a 2 story, 42 x 84 ft. addition to factory of 18th St. Estimated cost $40,000. J. M. Matson, Baker Blk., archt.

Ont., Toronto—Grinnell Co. of Canada, Ltd., 2440 Dundas St. W., awarded contracts for the construction of a 1 and 2 story galvanizing plant for galvanizing pipe and metal work. Estimated cost $150,000.

Que., Cap Chat—J. Richardson & Co., Ltd., plans the construction of a saw mill.